A SURVEY OF SELECTED PROVISIONS FOR HIGH SCHOOL SCIENCE INSTRUCTION IN FLORIDA

By
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DEDICATION

This study is dedicated to

Samuel Walton Harbin

and

Harry Faber

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I. STORY OF THE FLORIDA PROJECT

Introduction

The history of science is the story of mankind. Each episode has contributed to the lives of men and has resulted in effects, not only upon contemporary society, but upon posterity as well. Down through the ages, those contributions have modified both man and his environment to such an extent that it may be said that our culture has a technical disposition. So involved have we become in reaping the benefits of scientific application for immediate gain that many concurrent and future reactions to our genius may be overlooked. What man makes, man uses. It may well be that the balance of nature applies to those elements which are "manufactured" as well as "created."

History has demonstrated that the outcomes derived from the application of technical pursuits are both immediate and, though often more obscure, long-range in nature; our attention these days is directed toward both. Some cogent examples which illustrate this trend may be recognized in our present concern over problems related to radioactive fall-out, conservation of natural resources, and the so-called "population explosion." Furthermore, it is

acknowledged that man possesses nuclear weapons which may sow the seeds of his own destruction. It is clear that the need for an informed and perhaps technically oriented world society is pressing. This is not a new problem. Impetus is given to its consideration, however, when one takes a moment to speculate about the future. The question is not, "Will I survive?" but rather, "Will mankind?"

To preserve itself, any society is committed to public education. It, therefore, is an obligation for citizens to insure that the institutions of education are sufficient to satisfy the motivation that generated them. This is a continuing process. Examination and evaluation of our schools is one way that this may be done.

It seems that there is no lack of criticism concerning public education in the United States today. Examination and evaluation of schools is popular. Critics, to cite but a few, are drawn from the ranks of our armed forces (47), colleges and universities (8, 9, 16), and our lay public (51). Particularly popular targets for this censure are both the quality and quantity of science education at the secondary level. It requires little discrimination to note that these critics are sincere. The serious scholar, however, is more concerned with the nature of the research that generated such accusations. This writer does not choose to take exception to the

conclusions of those who judge but rather to the methodology employed. It is not unreasonable to insist that efforts to improve our schools be based upon research--research which sheds light both on what is and what should be.

Statement of the problem

While completing the course requirements for an advanced degree at the University of Florida, the writer had many opportunities to discuss the aforementioned observations with his advisor, Dr. N. E. Bingham. Perhaps a study could be devised which would evaluate the status of science education. Being particularly concerned with educational problems in Florida, it was decided to limit a study to that state and, furthermore, it was agreed that the research should lead to some dearly established methods of evaluating what is found. The problem then centers about:

1. Conducting a comprehensive survey concerned with the teaching of science in the secondary schools in the state of Florida.
2. Evaluating the findings.

For the sake of brevity, this endeavor will be referred to as the Florida Project.

History of the Florida Project

In the late summer of 1958, Dr. Charles Koelsche of the University of Toledo communicated with Dr. Bingham and proposed that Florida participate in a national study of the equipment and facilities used in the teaching of science in the four year high schools. Koelsche explained that his plans were to get enough financial support so that committees in the participating states could be organized to conduct visits to approximately 25 per cent of the high schools in these states. Being pressed for time and bearing the normal pressures of a full academic load, Dr. Bingham was unable to commit himself to the idea. However, he seized the opportunity to discuss the proposal with the author and together they gave it considerable thought. They agreed that Koelsche's plan offered a frontal attack on a segment of the Florida Project but they were eager to elaborate upon it and make it more comprehensive. Perhaps Koelsche's facility and equipment study could act as a vehicle for the Florida Project. The author met with Koelsche in Columbia, South Carolina, in October, 1958, to further discuss his proposal. It was explained to Koelsche that Dr. Bingham and the author were of the opinion that conducting a study such as he had outlined in Florida would enlist greater cooperation if it were made more comprehensive. Why not

take the opportunity to get additional data concerning the high school science programs while the facilities study was being made? The author told Koelsche of his dissertation proposal and how the request for cooperation fitted into the picture. Koelsche's interest in the Florida Project was gained and he agreed that his proposal was timely insofar as it could act as a vehicle for the Florida Project. The author committed himself to a leadership role in the study.

Related research

Upon his return to Florida, the author began to construct instruments which would yield the information necessary to evaluate the high school program for science instruction in the state of Florida. A search of the literature was conducted to find what had been done along similar lines by other researchers and to acquaint the author with the statistical methodology employed by them. The facilities of the University of Florida libraries were employed for this search. The author paid particular attention to the Education Index (volumes 1 through 11) and the various organs published by associations concerned with the issues confronting science education, such as The Science Teacher (The National Science Teachers Association) and Science Education (National Association for

Research in Science Teaching). Other valuable sources of information were volumes 16 through 19 of the Dissertation Abstracts and the many private conversations with science educators and scientists on the faculty of the University of Florida.

Before continuing the writer would like to remind the reader that the review that follows does not represent the entire field of research in science education. The reports have been selected as a sample of the kind of work that seems to have significance as far as the Florida Project is concerned and, furthermore, it is hoped that these selections will further acquaint the reader with the nature of research in science education.

The search of the literature revealed that little effort had been made to appraise the over-all structure of a secondary science education program. Reports of one or more of the many possible elements of such a study had been made and were not uncommon. As early as 1929, Zeismer (52) reported a study made of the academic and professional education of Wisconsin's science teachers. Similar studies have been reported by Baker and Brooks (7) in Kansas, Pella (42) in Wisconsin, Koelsche (29) in Ohio, and Anderson (5) in Oklahoma.

Enrollment studies are not necessarily a product of recent pressure to improve science education. State and

local levels have, by necessity, been in need of procuring accurate data concerning enrollments and course offerings for many years. Impetus has been given research in this area, however, and the frequency of reports has increased. Some noteworthy contemporary contributions have been made in Wisconsin by Pella (43), Ohio by Koelsche (30), and Florida by Sims (49).

The federal government has not been idle. Galen Jones of the Office of Education in the foreword to The Teaching of Science in Public High Schools (28) claims that the "study was undertaken to reveal the extent and nature of our science enterprise at high school levels" (28). In addition to other items, the study reports the science enrollments and offerings in a sample consisting of 733 of the nation's public high schools. A national study specifically concerned with secondary science enrollments and offerings was first made by an agency of the federal government in 1954 (12) and was followed by another in 1956 (13).

Additional evidence of federal interest in the problems related to the up-grading of science education is demonstrated in Mathematics and Science Education in U. S. Public Schools (25) published in 1958. This instrument is the report of the American Association of School Administrators and the Council of Chief State School Officers.

The purpose of the conference was to develop guidelines for program appraisal and to evaluate the various proposals then being made for changes in school programs.

Maneval (35) undertook a status study of the teaching of physics in Oklahoma secondary schools in 1951 and compared his findings with a similar study made in 1922. A significant decrease in the number of girls taking physics was observed.

Reflecting an early interest in some of the problems and needs besetting science education in the United States, the Committee on the Teaching of Biology of the Union of American Biological Societies sponsored and published a report (48) of results from a questionnaire. The Carnegie Corporation of New York provided a grant which made the study possible. Each section of the report was prepared by a different author and, although they admit that the survey contains certain technical weaknesses, it is an outstanding contribution to science education, as it represents perhaps the first reported survey of a comprehensive nature. The following paragraphs from the foreword help to expose the nature of the undertaking.

> In this study it was desired especially to learn what high school biology teachers themselves think of their many problems. But it was hoped also to get information which may, in some degree, enable others to evaluate the teachers and the teaching of the subject. Admittedly the data thus obtained--from one group only and from

> questionnaires--fail to provide a complete view of the subject. While pronounced irregularities in the educational sample obtained are recognized, it is thought nevertheless that the material assembled here will prove valuable to those seriously concerned with either education or with any aspect of biological work.
>
> Perhaps a survey of this kind may not be expected to have both breadth and depth, nor either of these in satisfactory degree. The need for information justified an inquiry into many aspects of the problem; . . . The authors hope that the results of this study will stimulate interests in and steps toward an early solution to the problems of the teaching of biology in our secondary schools; and especially that data obtained with considerable difficulty may assist educators and biologists in the recognition and performance of the individual and group tasks necessary for a much-needed improvement and extension of biological instruction in the high schools of this country. (48, p. 76)

The Committee of the Teaching of Biology sent nearly 16,000 copies of a rather lengthy questionnaire to teachers throughout the United States. Returns from 3,186 teachers were analyzed. The nature of this analysis is revealed by noting the different chapter headings:

I. General information on the experience and the subjects taught by biology teachers.
II. Enrollments, teaching loads, and college relations of the secondary school biology.
III. The training of biology teachers.
IV. Buildings, equipment, and text-books used by teachers of biology in secondary schools.
V. Community backgrounds and school organizations.
VI. Amount and nature of biology teaching in secondary schools.

Although this work is limited to the area of biology, it

is more extensive in scope than any analytical study up to that time.

Martin (36) studied an even narrower segment of a similar problem in an effort to obtain related information during 1949 and 1950. Questionnaires were sent to 1,072 high schools in the United States and the data (obtained from a return of 73.3 per cent) were compared to previous studies in the same area.

It seems that most of the research in science education has not been of an experimental nature. Common among the many methods of securing data are the following techniques: interviews, surveys, and analysis of published material, questionnaires, and expert opinion. Experimental research in secondary science has not been lacking, but it has not been common. As is the case in most experimentation, acknowledging the existence and accounting for the variables which are significant is a most difficult and engaging task. This serious limitation is imposed upon much research but it appears to be universally recognized and the carefully constructed study is accepted in spite of it.

Just a few of the experimental studies seem relevant as far as the Florida Project is concerned. Mallinson (34) conducted a study which sought to compare individual laboratory experiences and lecture-demonstration

experiences in the teaching of general biology. The results indicated that the individual laboratory shows a slight trend toward the better preparation of students for the General Biology Regents than does the lecture-demonstration method. In a similar study in the area of chemistry, Lucow (33) demonstrated that a text-book centered versus a laboratory centered high school chemistry course resulted in significant increases in variation as far as the laboratory group was concerned. It is interesting to note that both methods in the experiment were shown to be effective in learning chemistry.

In an experiment designed to compare the effect of field trips upon the development of scientific attitudes, Harvey (24) showed that the experimental group did significantly better than the control group. She concluded that field trips can act as an instrument to improve scientific attitudes and that elements of scientific method can be used on such trips.

Working with 192 students from eight Kansas high schools, Anderson (4) contrived an experimental attempt to discover the relative value of various multi-sensory methods in the teaching of high school biology. In a technique involving analysis of variance and covariance, it was concluded that a combination of sensory aids is desirable for teaching biology. It was found that the

group having the most sensory experiences achieved significantly more than any of the other groups which did not differ significantly from one another.

Problems relative to science teacher education have been of concern to researchers. Unfortunately, the assault upon this issue has been frustrated because of lack of agreement on what constitutes adequate preparation to be a qualified teacher. In spite of this shortcoming, the authorities in the field of science education agree that prospective science teachers should have about one-half of the work for the Baccalaureate Degree devoted to science courses. This recommendation is made in both the thirty-first (38) and the forty-sixth (39) Yearbooks of the National Society for the Study of Education. The American Association for the Advancement of Science Cooperative Committee on Science Teaching has consistently recognized this as a sound proposal (3, 45).

On the basis of a questionnaire sent to beginning science teachers and administrators, Nelson (41) and Ming (37) demonstrated that they tended to agree with the recommendations of the NSSE and the AAAS. Assuming that student achievement is a measure of teacher competency, Anderson (5) found that student achievement in both high school biology and chemistry varied directly as the science preparation of the teachers. The same trend was disclosed

when teachers with the Master's Degree were compared to those with the Bachelor's. The findings of this study certainly lend support to appeals for academic rigor.

In light of the foregoing, the implications of Neivert's study (40) stand out. She investigated the problems of identifying secondary students with science potential and of determining what factors are responsible for selecting science as a career. She concluded that the science teacher is the single most important factor in the school environment conducive to development of potential science students.

Efforts to disclose information relative to the influence that teachers exert have been undertaken and several of these have significance as far as the Florida Project is concerned. Bloom (10) in a study restricted to data obtained from three New York City high schools sought to determine why some schools produce an unusually high number of Science Talent Search winners. In light of his findings, he suggested that it is desirable to provide opportunities for student exploration through participation in extracurricular activities, such as science clubs, science fairs, and similar undertakings. Gladieux (23) suggests that the most important element involved in the success of an extra-class activity appears to be the availability and the willingness of a science teacher to

assume the responsibility for sponsorship, and that a factor which reduces the effectiveness of science teachers directing such activities is that they are assigned too many non-teaching, non-science duties. In support of this finding, Abbas (1) reports that the load of the science teacher was a significant factor in influencing his philosophy of education and that science teachers with a weekly class load of more than 25 classes displayed a greater degree of indifference than teachers with a lighter load. In another study by the same author (2), it was found that the higher the educational qualifications of a teacher, the more likely he was to endorse and practice educational experimentalism. One is led to speculate that the more nearly a school departs from the so-called "traditional" activities, the greater the academic achievement of its students. This notion becomes more credulous if one reconsiders the research relative to student achievement and the identification of science talent.

In summary, the finding of the library search for reports of studies relative to the Florida Project revealed the following:

1. Status studies concerned with secondary science education were limited both in scope and the size of the sample selected.

2. Laboratory experiences enhance student achievement.
3. A variety of audio-visual teaching aids should be employed in teaching secondary science.
4. Science fairs, science clubs, science projects, and other student-teacher projects are conducive to developing science talent.
5. The science teacher appears to be a significant contributing factor in the development of science talent.
6. Students achieve more under the direction of teachers with more academic background when compared to those with less academic background.
7. Students achieve more under the direction of teachers with Master's Degrees when compared to those with Bachelor's Degrees.
8. Load of the science teacher affects teacher attitudes and willingness to work with students on projects, fairs, clubs, etc.

In general, it was observed that little effort had been made to appraise the over-all program for science instruction in the high schools of the United States. Numerous reports of a particular nature concerning such

elements as the learning process, teacher training, and curriculum do appear in the professional literature. However, little synthesis of the findings and application of them seems to have been invoked.

The review of the literature rewarded the author with many ideas and with particular studies to support some of the items being included in the instrument which was then in the process of being designed for the Florida Project. This was being done during the fall of 1958 with the anticipation that the study would get underway the following spring. It soon became clear that the final form of the instruments would have to be delayed until the instrument that Koelsche designed had been examined. It would be foolish to duplicate items and it was decided that rough drafts of the author's instruments would be prepared. If necessary, certain items could be deleted pending examination of what Koelsche was preparing.

Committee selection

Though Koelsche had worked out elaborate plans for organizing a committee to conduct the survey, it was the author's intention of visiting all of the schools selected in the sample and he had tentatively made provisions for doing this during the spring semester. No course work was planned and full time was to be devoted to conducting the survey. When the spring semester commenced, Koelsche

informed the author that he had taken a position with the United States Office of Education as Secondary Science Consultant and that the financial arrangements for the study had not yet been completed. Circumstances compelled the author to take a position teaching at the University of Florida; when funds finally became available (through the combined resources of the United States Office of Education and the Research Foundation of the University of Toledo), the author found that he no longer had the time to visit the schools as planned. With Dr. Bingham's assistance, and following Koelsche's suggestions, a committee of ten was organized to conduct the survey. The factors used to select members of this committee included the following:

1. Interest in science education and in the proposed study.
2. Science and technical background.
3. Familiarity with high school science programs.
4. Geographic location.
5. Availability.

A copy of Dr. Bingham's letter to prospective members of the state committee is included in Appendix I to acquaint the reader with the details of this function and the author's part in the project.

The committee finally selected to conduct the

survey was composed of the following men:

1. Dr. Luther Arnold
   Associate Professor of Science Education
   University of Florida

2. Mr. Fred W. Ashton
   Retired Research Petrographer
   Universal Atlas Cement Company

3. Mr. Robert Binger
   Science Consultant, Division of
   Instructional Field Service
   Florida State Department of Education

4. Dr. N. E. Bingham (Director of state committee)
   Professor of Science Education
   University of Florida

5. Mr. Shepard Faber
   Teaching Assistant, Department of Physics
   University of Florida

6. Mr. Jerry Fink
   Graduate Student in Education
   University of Florida

7. Dr. Earl R. Glenn
   Retired Chairman, Science Department
   New Jersey State Teachers College

8. Mr. Charles Partin
   Curriculum Consultant
   Escambia County, Florida

9. Dr. Oscar Riddle
   Retired Biologist
   Carnegie Institution, Washington

10. Mr. Wyatt S. Wood
    Retired Director of Installations
    Western Union Telegraph Company

The Florida State Superintendent of Public Instruction, Mr. Thomas Bailey, was consulted and the cooperation of the Florida State Department of Education was

officially obtained. Mr. Bailey expressed his interest in the study by making available the resources of the State Department and by assigning Mr. Robert Binger, the newly appointed Science Consultant, to work with the committee.

Project initiation

On March 15, 1959, the author met with Koelsche as planned and had an opportunity to examine the inventory that Koelsche had prepared concerning the facilities and equipment for teaching high school science. Upon examination, it became clear that many items appearing on his check lists were also on the rough draft of the instrument the author had prepared. This had been anticipated and the author's instruments were reconstructed and refined at a meeting that same day with Dr. Bingham and Dr. Arnold, of the University of Florida (Appendix II contains replicas of the instruments used in the Florida Project). At this meeting, it was decided that the Florida Project would not include an investigation of the kinds of methodology the teachers of science employ in their individual classrooms but would be limited to enrollments, course offerings, facilities, equipment, and the academic preparation of science teachers. The data sheets and questionnaires were designed to facilitate the gathering of information relative to same.

A teacher questionnaire was constructed to obtain information concerning the science teachers and their perceptions. Assuming that the science teachers would prefer to submit their responses both voluntarily and anonymously, provisions were designed for these contingencies. An additional check sheet was prepared for use in examining the academic backgrounds of the teachers. It was planned that a search of their college transcripts (which were on file with the State Department of Education, Tallahassee, Florida) would be made to obtain this data. The instruments used for procuring this data are included in the appendix.

On March 16, 1959, at a conference of the state committee selected to engage in the Florida Project, the function of the committee and of each member was carefully outlined. It was explained that they had been selected to help procure data relative to a survey of selected provisions for secondary science education in the state of Florida; that they would do this by visiting selected high schools, and there complete (with the help of school officials, principals, and science teachers) instruments designed to yield the necessary information. Standardization of research technique was sought by a meticulous review of the instruments designed for committee use; every effort was made to satisfy questions and explain

terms so as to unify the methods of procuring data. The committee offered suggestions and helped in further refining the instruments finally used. They felt it particularly important that some mention of their perceptions be given in the final report.

The sample of 81 high schools[1] from which visitation assignments were made was selected from the three, four, and six year high schools listed in the 1958 Florida Educational Directory (14) and they represented 25 per cent of the high schools in the state at that time. The selection of the sample was made by Koelsche. It was through his office and the Research Foundation of the University of Toledo that funds were made available for the project. Since his interest was in the facilities and equipment aspect of the study and, furthermore, since this represented an element of a larger national study, it was important for him to maintain uniformity of sample selection in the several states participating in the national project. It may have been better

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[1] A high school for purposes of this investigation is taken to be a school that has grades nine through twelve or ten through twelve. If a school has grades seven through twelve, or one through twelve, for example, it was included in the population from which the sample was selected. Insofar as was possible, consideration was given only to those elements of the school program that were pertinent to this investigation. Of the 81 high schools selected, 56 were white and 25 were Negro.

to choose the sample, as far as the Florida Project was concerned, another way. Under the circumstances, however, it was necessary to select the sample by the same method used in the other states connected with the project.

The method used for identifying the schools involved in the project was to consecutively number the population of the public high schools listed in the 1958 Florida Educational Directory and match them with numbers obtained from the table of random numbers compiled by Fisher and Yates (19). An alternate list of ten schools was selected in the event that some would not care to participate in the project. Letters were written to the principals of the schools selected in which the nature of the project was carefully explained and their cooperation requested.

Summary

The Florida Project, an investigation of the status of high school science education in Florida, was designed with the anticipation that both the quality and the quantity of certain selected elements chosen for study could be evaluated. A random selection of 25 per cent of the high schools of the state was chosen as the sample. Some of the research was conducted by a committee of men selected from the ranks of interested science educators and scientists.

These men visited a total of 81 high schools and there completed, with the assistance of school officials, check lists and inventories. Additional data were obtained from returns of a teacher questionnaire, and from an analysis of the records of each of the science teachers employed in the schools included in the survey.

The following chapters contain the findings and conclusions resulting from this survey.

II. ENROLLMENTS AND COURSE OFFERINGS

Introduction

Florida, in common with its neighboring states, has subscribed to the practice of separating the white and Negro races in public schools. At the time of the Florida Project, this arrangement had been in effect for more than fifty years and was maintained by the inertia of public sentiment. The policy of separating the races has resulted in one school administration at the state level which theoretically controls and helps to provide for the needs of the two school systems which operate at the local level. In Florida, the practice of the historic-legal doctrine of separate but equal schools has been met with varying degrees of interpretation at the different administrative levels. Although the state school administration encourages equal schools for the races and legally provides for them under certain terms of the Florida Minimum Foundations Program, discrepancies are a historical fact and a contemporary problem. Consequently, in discussing Florida's schools, care must be taken to identify the segment of the school population to which one is referring. In order to interpret the data obtained in the Florida

Project, this will be done and the findings for the two races will be distinguished. However, in keeping with the study as carried out in the other states, the data will also be summarized from all of the sample as a unit.

Findings related to enrollments--white

Tabulation of the types of white public high schools in Florida and those selected for the survey is shown in Table 1. Of the 214 white public high schools listed in the 1958 Florida Educational Directory (20), 56 were selected and reported data used for this investigation.

TABLE 1

TYPES OF WHITE PUBLIC HIGH SCHOOLS IN FLORIDA IN 1958-59 COMPARED WITH THE HIGH SCHOOLS WHOSE REPORTS WERE USED IN THIS STUDY

Type of School	Number in Florida	Number Reporting Data for Study
K- 12	4	1
1- 12	83	30
6- 12	2	1
7- 12	55	13
8- 12	5	1
9- 12	24	4
10- 12	41	6
Totals	214	56

The largest single group of the schools selected were of the 1- 12 type and constituted about 54 per cent of the sample. The next largest groups were the junior-senior high schools and the senior high schools; they accounted for 23 per cent and 11 per cent of the sample, respectively. One or more of each type of school listed in the directory was visited. In the investigation data on all grades, below nine was not considered.

Table 2 breaks down the number of white high schools in the sample both to type and to size of school.

TABLE 2

NUMBER OF WHITE HIGH SCHOOLS IN THE SAMPLE GROUPED AS TO THEIR 1958-59 ENROLLMENT AND TYPE

Type of School	Size of School					
	1 - 199	200- 499	500- 999	1000 up	Totals	Per Cent
Grades K- 12	1				1	1.8
Grades 1- 12	27	2	1		30	53.6
Grades 6- 12		1			1	1.8
Grades 7- 12	1	6	5	1	13	23.2
Grades 8- 12		1			1	1.8
Grades 9- 12		1	2	1	4	7.2
Grades 10-12		1	2	3	6	10.8
Totals	29	12	10	5	56	
Per Cent	52	21	18	9		

According to these data, 9 per cent of the schools had enrollments of 1,000 or more; about three-fourths of the schools had enrollments below 500; and 52 per cent below 200. A comparison of Tables 1 and 2 reveals that schools of the 1- 12 type are the most numerous but have the smallest enrollment. Twenty-seven of the 29 schools of this type were in the smallest size category. This fact is further revealed by an examination of Table 3 in which the number of students attending white schools is categorized by grade and size of school.

TABLE 3

NUMBER OF STUDENTS ATTENDING WHITE SCHOOLS CATEGORIZED BY GRADE AND SIZE OF SCHOOL

	Size of School				
Grade	1-199	200-499	500-999	1000-up	Totals
Ninth (Freshman)	937	1,032	1,632	523	4,124*
Tenth (Sophomore)	801	1,116	2,129	2,864	6,910
Eleventh (Junior)	710	862	1,648	2,486	5,706
Twelfth (Senior)	532	658	1,273	1,870	4,333
Totals	2,980	3,668	6,682	7,743	21,073

*Ninth grade total enrollment low due to the fact that six senior high schools in the sample enrolled no students below tenth grade.

In this table, it is seen that about one-seventh of the sample population was enrolled in schools having fewer

than 200 students.

One would expect that the number of each type of school be representative of the total number of each type in the state. Table 4 compares the number of schools of each type in the state and in the sample. Some of the types of schools have been grouped according to natural similarities to facilitate interpretation of the data. Examination of Table 4 reveals that the sample contains about expected numbers in the 6-, 7-, 8-12 categories; however, the number of three and four year high schools is lower than desired for a representative sample. Furthermore, the twelve and thirteen year schools selected are too plentiful.

In the author's judgment, the sample of the white high schools selected does not systematically represent a cross section of high schools in Florida. Additional evidence to support this contention may be gained from considering the enrollments in the sample and comparing it to the total enrollment in Florida's white high schools. The sample enrollment of 21,073 students (Table 3) represents nearly 11 per cent of the total white enrollment in grades 9- 12 in Florida--not 25 per cent, as hoped.

The method of choosing the random sample was designed to include no less than 25 per cent of the high schools as has been outlined in Chapter I. The actual

TABLE 4

NUMBER OF SCHOOLS OF EACH TYPE IN FLORIDA AND IN THE SAMPLE SELECTED SHOWN AS PER CENT OF TOTAL

Type of School	Number in Florida		Per cent of Total	Number in Sample		Per cent of Sample
K- 12	4	87	41	1	31	55
1- 12	83			30		
6- 12	2			1		
7- 12	55	62	29	13	15	27
8- 12	5			1		
9- 12	24		11	4		7
10-12	41		19	6		11
	214		100	56		100

sample selected included 26 per cent of the state's white high schools and thus met the above condition. However, one also hopes that a sample, in addition to being significantly large, also meets certain qualitative criteria as well--among these is that the sample be quantitatively representative of the population. This condition has obviously not been met by the 56 white high schools investigated. Though the method of sample selection outlined in Chapter I guarantees randomness, it does not insure a proportional population representation--although this may accidentally occur. It seems clear that the sampling technique should have been modified to include

some method of stratification with respect to school size to insure a more representative sample.

In spite of the foregoing weakness in the sample, namely too many small schools and too few large schools, it need not be discarded. One needs, however, to recognize its limitations and to interpret data in light of them; inferences to the population must be made with care.

Findings relative to science offerings--white

The science offerings of the white high schools are given in Table 5.

TABLE 5

SCIENCE OFFERINGS OF THE WHITE SCHOOLS CATEGORIZED BY SUBJECT AND SIZE OF SCHOOL

Subject	Size of School				Totals
	1-199	200-499	500-999	1000-up	
	29*	12*	10*	5*	56
General Science	21	11	8	1	41
Biology	29	11	10	5	55
Chemistry	14	10	10	5	39
Physics	13	10	9	5	37
Physical Science	6	1	2	3	12
Zoology	0	0	0	1	1
Physiology	0	1	1	3	5
Advanced Biology	0	0	0	1	1
Advanced Gen. Sci.	0	2	0	1	3
Advanced Chemistry	0	0	0	1	1

*The total number of schools in the category.

Of the 56 schools in the sample, 73 per cent offered general science, 98 per cent biology, 70 per cent chemistry, 66 per cent physics, and 21 per cent physical science. Physiology was offered in five schools and advanced general science in three. Zoology, advanced biology, and advanced chemistry were each taught in one school.

Noting the comparative number of schools which offer a particular science course may tend to be misleading. A relatively large number of schools may offer a particular course, but do these schools enroll a proportionate segment of the total school population? Assuming that students are desirous of enrolling in science courses, it becomes important to measure the access they have to them. In order to do this, Table 6 was constructed in which the "access" is measured in terms of per cent.

A rating of 100 per cent for a particular course or courses is interpreted to mean that all of the students in a given school size category are attending schools in which that course or these courses are offered. In other words, a response of 100 per cent demonstrates complete availability. Table 6 was made this way: for each subject or subject category, the combined enrollment for those schools in which a particular course was offered was calculated; this sum was then compared to the total school

population or the population for the different size categories, the ratio being expressed as per cent. Inasmuch as general science was not taught in any of the three senior high schools in the sample, the access figure for this course was determined by considering only those schools that had a ninth grade.

TABLE 6

ACCESS TO THE SCIENCE COURSES IN THE WHITE HIGH SCHOOLS EXPRESSED AS PER CENT

Subject	Size of School				All Schools
	1-199	200-499	500-999	1000-up	
General Science*	80*	100*	100*	100*	95*
Biology	100	90	100	100	98
Chemistry	53	82	100	100	86
Physics	47	84	80	100	83
Three sciences	66	90	89	100	90
Four sciences	18	78	83	100	79
Five sciences	0	13	26	80	40
Six sciences	0	13	0	38	16

*Data figured only on the basis of those schools having a ninth grade.

The overall access to general science was 95 per cent; the only significant discrepancy being 80 per cent in the smallest school category. Ninety-eight per cent of the students in the survey had access to a biology course, 86 per cent to chemistry, and 83 per cent to physics.

Ninety per cent of the students were enrolled in schools in which any three of the conventional quadrumvirate of general science, biology, chemistry, and physics were available; 79 per cent had access to four science courses; 40 per cent to five; and 16 per cent to six. No school in the survey offered more than six different science courses. Access, in general, was supplied to the greatest extent in Florida's largest school size category. One hundred per cent of the students in schools enrolling 1,000 or more students could theoretically have elected to take four years of science in their high school program. In the same size cateogy, 80 per cent is the access to a five year offering; 16 per cent is the figure for a six year program. In contrast, schools enrolling less than 200, the smallest size category in the sample, had universal access in only one science subject--biology. In general science, access in the small schools was 80 per cent; in chemistry, 53 per cent; and in physics, 47 per cent. In these schools, 34 per cent of the students could not have elected a three year science program; 88 per cent had no access to a four year curriculum in science; and none of them had access to five or six different science courses.

The data on enrollment force one to consider the discrepancy that exists between the large schools and

the small schools. If we assume that all other factors are equal and acknowledge only the fact that the science curriculum in the larger schools is more extensive than the curriculum in those with less enrollment, it is clear that the academic ambitions of youngsters in the latter group are in jeopardy. This does not suggest that there are differences in the quality of the offerings, though they may exist, but rather that there are differences in the quantity--differences that no doubt deny youngsters educational opportunity.

In comparing the course offerings and school size, it is seen that the schools with the largest enrollment have the most extensive science curriculum. The smallest schools concentrate on teaching general science, biology, chemistry, and physics, with particular emphasis placed on the two former. Noting that there are 29 schools in the 1-199 size group and that 14 of them teach chemistry and 13 of them teach physics, one is led to wonder how many of them alternate these courses as is the custom in smaller schools. Examination of the data sheets discloses that 19 of the 56 schools in the sample alternate these science courses; 18 of these schools are in the smallest size category. The larger schools offer a greater variety of courses and, furthermore, they are available to students from year to year. Another glance at Table 6 reveals that

about half of the schools in the smallest size category offer either chemistry or physics, whereas, virtually all the schools in the larger categories offer both. The largest schools clearly have the most elaborate science curriculum.

An examination of Table 7, in which the average number of different science courses taught in a school is arranged according to type of school and school size, discloses that the schools in the 1-199 size category offer 2.8 science courses, and that the schools with enrollments of 1,000 or more offer an average of 5.4 science courses. This trend is clearly established by considering each category of school size and its offerings average: 2.82, 3.5, 4.1, and 5.4 different science courses--given from smallest to largest school size, respectively.

TABLE 7

AVERAGE NUMBER OF DIFFERENT SCIENCE COURSES OFFERED IN THE WHITE HIGH SCHOOLS ARRANGED ACCORDING TO TYPE OF SCHOOL AND SCHOOL SIZE

Type of School	Size of School				Average
	1-199	200-499	500-999	1000-up	
K- 12	3	---	---	---	3
1- 12	2.8	3.5	4	---	2.9
6- 12	---	4	---	---	4
7- 12	3	4	4.6	5	4.2
8- 12	---	4	---	---	4
9- 12	---	6	3.5	5	4.5
10-12	---	1	3.5	5.7	4.2
Average	2.8	3.5	4.1	5.4	

TABLE 8

THE NUMBER OF SCIENCE CLASS SECTIONS IN THE WHITE SCHOOLS, THEIR TOTAL ENROLLMENT, AND THE AVERAGE* SIZE OF SCIENCE CLASSES, GROUPED ACCORDING TO SCHOOL SIZE

Subject	Size of School				Totals
	1-199	200-499	500-999	1000-up	
General Science:					
Sections	27	26	31	8	92
Enrollment	610	679	991	255	2,535
Average	23	26	32	32	27
Biology:					
Sections	37	33	61	92	223
Enrollment	855	909	1,897	2,636	6,297
Average	23	28	31	29	28
Chemistry:					
Sections	16	11	28	37	92
Enrollment	283	237	678	904	2,102
Average	18	22	24	24	23
Physics:					
Sections	11	11	10	15	47
Enrollment	182	193	236	358	969
Average	17	18	24	24	20
Physical Sci.:					
Sections	6	1	2	18	27
Enrollment	104	18	43	590	755
Average	17	18	22	23	28
Others:					
Sections	0	2	2	14	18
Enrollment	0	44	41	349	434
Average		22	21	25	24
Total Science Enrollment	2,034	2,080	3,886	5,092	13,092
Total Science Sections	97	84	134	184	499
Average Size	21	25	29	28	26

*Shown to nearest whole number.

The data on science enrollments are given in Table 8. The total enrollment in all of the science courses offered in the 56 white high schools visited was 13,092. Approximately 30 per cent of this total enrollment was in the 41 schools with fewer than 500 students. The five schools with enrollments of 1,000 or more accounted for nearly 40 per cent of the total. Of the 21,073 students in these schools, 37 per cent were enrolled in schools in which enrollments were greater than 1,000. The science enrollment in the larger schools is obviously proportional to total school population. Students taking general science accounted for 19 per cent of the total science enrollment; biology, 48 per cent; chemistry, 16 per cent; and physics, 7 per cent. The average class size seems to be related to school size, the smaller schools usually having the smallest average science class size. Consider the excerpt from Table 8, shown below, in which the average science class size is compared with school size.

Subject	Size of School			
	1-199	200-499	500-999	1000-up
General Science	23	26	32	32
Biology	23	28	31	29
Chemistry	18	22	24	24
Physics	17	18	24	24

In only three cases, above, are average classes larger than 30 students, and these occur in the larger schools. Science educators agree that class size should be limited to 30 students. Using this as a criterion, excessive enrollments in science classes did not seem to be common. Unfortunately, the figures shown in Table 8 are mathematical means; this may lead to error. Suppose, for example, a school offered three sections of biology and the number of students in each section was 25, 30, and 35, respectively. The average enrollment here is obviously 30--an acceptable limit. Yet, more than one-third of the students taking biology are in an over-loaded class. It is, therefore, important to ascertain the absolute frequency of over-loading. Unfortunately, the data sheets do not completely permit this needed interpretation and it is a weakness in their design. It may be that the meager enrollment in the large number of small schools disguises the frequency of over-loading which really exists in the Florida schools. In order to test this suggestion, Table 9 was constructed in which the number of science class sections in which the average enrollment equals or exceeds 31 students was compared to the number of sections in each size category for the four most popular subjects.

TABLE 9

THE NUMBER OF SCIENCE CLASS SECTIONS IN WHICH THE AVERAGE ENROLLMENT EQUALS OR EXCEEDS THIRTY-ONE STUDENTS COMPARED TO THE NUMBER OF SECTIONS, ARRANGED ACCORDING TO SCHOOL SIZE FOR THE FIVE MOST POPULAR SCIENCE SUBJECTS

Subject	Size of School							
	1-199		200-499		500-999		1000-up	
	T	O	T	O	T	O	T	O
General Science	27	2	26	12	31	19	8	8
Biology	37	2	33	5	61	25	92	0
Chemistry	16	0	11	0	28	0	37	4
Physics	11	0	11	2	10	1	15	0
Totals	97	4	84	19	134	45	184	12

T = total/O = overload

An analysis of Table 9 reveals that the over-crowded science classes seem to be concentrated in schools having enrollments of more than 200 students and less than 1,000. Just 4 per cent of the 97 science classes in the smallest schools had average enrollments greater than 31, whereas, 22 per cent and 33 per cent of the sections in the next two size categories were over-crowded. For schools that enroll more than 1,000 students, the over-crowded sections account for 7 per cent. The low incidence of average over-crowding in the smallest schools, coupled with the fact that these schools account for just 15 per cent of the total sample population, does not support the notion that the relatively small enrollment in these

schools disguises the actual over-crowing in Florida's science classes. Furthermore, about 40 per cent of the students in the sample were enrolled in schools having enrollments of more than 1,000, but in these schools the incidence of average over-crowded science classes was actually less than 7 per cent. Thus, the over-crowded science sections are concentrated in the 45 per cent of the sample enrolled in schools containing more than 200 but less than 1,000 students. Specific occurrences of over-crowding are common in general science and biology, particularly in schools enrolling 500-999 students. The foregoing evidence does not suggest that over-loaded science classrooms are common since no more than 80 science sections out of 498 could possibly have enrolled more than 31 students. Of course, each school should strive to reduce its over-loaded classes, particularly if a given school is characterized by this problem; but this condition does not describe the schools in this sample.

Table 10 shows, by per cent, the enrollment in the white science classes compared to total school and grade enrollment. According to these data, 62 per cent of all the students in the 56 white high schools were taking a course in science. The smallest enrollment group had the largest relative science enrollment; the schools in the next size category had the smallest. The table reveals that

17 per cent of the students were enrolled in general science; 30 per cent in biology; 10 per cent in chemistry; and 4.6 per cent in physics. No enrollment trends seem to be apparent. The "all schools" column suggests the overall situation, as the range within the size categories is meager in most cases. Biology is a required subject in many of Florida's schools and is commonly taken by students in the tenth grade. According to Table 10, 91 per cent of the sophomores enroll in this course; chemistry, traditionally a junior course, enrolls 36.8 per cent of the eleventh grade; and physics, commonly a senior subject, accounts for 22.4 per cent of the twelfth grade. In general, the data support the contention that more students in the small schools take more than one science course than do students in the other schools.

Summary of enrollments and course offerings--white

The random sample, composed of 56 white public high schools, enrolled a total of 21,073 students and represented 11 per cent of Florida's total public school enrollment, grades nine through 12, during the 1958-59 academic year. Nearly three-fourths of these schools had enrollments of fewer than 500 students; one-half had enrollments of less than 200; nearly 10 per cent had more than 1,000 students. More than one-third of the total number of students

TABLE 10

ENROLLMENT IN WHITE SCIENCE CLASSES COMPARED WITH SCHOOL AND GRADE ENROLLMENT, RECORDED AS PER CENTS

Items	Size of School				All Schools
	1-199	200-499	500-999	1000-up	
Per cent of total enrollment in:					
Science classes	68.0	56.7	58.2	65.8	62.0
General science	20.4	18.5	14.8	3.3[+]	17.1[≠]
Biology	28.6	24.8	28.4	34.0	30.0
Chemistry	9.5	6.5	10.1	11.7	10.0
Physics	6.1	5.3	3.5	4.6	4.6
Other Sciences	3.8	1.7	1.3	12.1	5.7
Per cent of freshman class in general science*	65.0	65.7	60.8	48.8[+]	60.5[≠]
Per cent of sophomore class in biology*	107.5	81.5	89.0	91.9	91.0
Per cent of junior class in chemistry*	39.5	36.4	41.1	36.8	36.8
Per cent of senior class in physics*	34.2	29.4	18.5	19.1	22.4

*These figures may be slightly skewed due to the fact that enrollment is not limited to class. Some seniors, for example, take junior courses.

[+]Only two schools in this category enrolled freshman; others were three year senior high schools.

[≠]These averages computed by using data from first three categories.

in the sample were attending schools enrolling 1,000 or more, whereas, one-seventh of the students were enrolled in the smallest schools. All schools enrolling 500 or more accounted for more than twice as many students as the other schools.

In terms of how many schools in the sample offer a given course, biology was, by far, the most common. Fifty-five of the 56 schools offered it, the lone exception being due to the inclusion in the sample of a technical high school in which biology is not normally offered. The next most frequently occurring course was general science (41), followed closely by chemistry (39), and physics (37). The above frequencies, however, need to be interpreted on the basis of student availability. It was found that some of the schools that one would expect to offer a general science course did not do so, the result of this being that 5 per cent of the 21,073 students in the sample had no access to such a course--that is, they could not have taken general science had they wanted to. Only 2 per cent of the students had no access to biology; 14 per cent had no chemistry available; and 17 per cent had no opportunity to study high school physics. A three course science sequence was open to 90 per cent of the students and a four course sequence theoretically closed to 21 per cent. The most extensive science curricula were

offered by the largest schools in which the average number of different science courses offered was 5.4; for the smallest schools, the number was 2.8.

Of the 21,073 students attending schools sampled, very nearly two-thirds (13,092) were taking one or more science courses and of these about one-half were taking biology. General science enrolled about one-fifth; chemistry, one-sixth; physics, one-thirteenth; and the total enrollment in all other science courses constituted less than one-tenth of all those taking science. In general, a somewhat larger proportion of the students in the small schools enroll in science courses than do students in the larger schools.

Limiting maximum science class size to 30 students, it was found that less than 16 per cent of the science classes could have been larger. The top figure is less than 80 sections out of a total of 499.

Findings relative to enrollments--Negro

Tabulation of the types of Negro public high schools in Florida and those selected for the survey is shown in Table 11.

Of the 105 public Negro high schools listed in the 1958 Florida Educational Directory (20), 25 were selected and reported data used for this investigation. The largest

single group of schools selected were 12-year schools and they accounted for over half of the schools in the sample. The next largest group were six year high schools and they composed slightly less than one-fourth of the sample. Seven of the nine different types of schools were visited but data on all grades below nine were not considered.

TABLE 11

TYPES OF NEGRO PUBLIC HIGH SCHOOLS IN FLORIDA IN 1958-59 COMPARED WITH THE HIGH SCHOOLS WHOSE REPORTS WERE USED IN THIS STUDY

Type of School	Number in Florida	Number reporting data for study
K- 12	1	1
1- 12	64	13
4- 12	1	0
5- 12	1	1
6- 12	1	0
7- 12	26	6
8- 12	2	1
9- 12	3	1
10-12	6	2
Totals	105	25

Table 12 breaks down the number of Negro high schools in the sample, both as to the type and to the size of school.

According to these data, only one school of the 25 in the sample had enrollments of 1,000 or more; four had enrollments of 500 to 999; combined, these schools comprised 20 per cent of the sample. Schools enrolling fewer than 500 students accounted for the remaining 80 per cent. Fifty-two per cent of the Negro schools surveyed had less than 200 students.

TABLE 12

NUMBER OF NEGRO HIGH SCHOOLS IN THE SAMPLE, GROUPED AS TO THEIR 1958-59 ENROLLMENT AND TYPE

Type of School	Size of School				Totals	Per Cent
	1-199	200-499	500-999	1000-up		
Grades:						
K- 12		1			1	4
1- 12	13				13	52
5- 12		1			1	4
7- 12		3	3		6	24
8- 12		1			1	4
9- 12		1			1	4
10-12			1	1	2	8
Totals	13	7	4	1	25	
Per Cent	52	28	16	4		

A comparison of Tables 11 and 12 reveals that schools of the 1- 12 type are the most common but have the smallest enrollment. All 1- 12 schools in the sample had

enrollments below 200; the average enrollment of these schools in grades nine and above was 107.

An examination of Table 13, in which the number of students attending Negro schools selected in the sample are categorized by grade and size of school, reveals that 52 per cent of the schools enrolled barely 17 per cent of the students--these schools being the smallest ones. The seven schools in the next largest size category (200-499) account for one-fourth of the sample. For the remaining five schools, representing one-fifth of those visited, very nearly six-tenths of the sample population is recorded. It is interesting to note that the one school enrolling 1,000 or more students accounted for a greater portion of the sample than did the 13 in the smallest size category.

One index relative to the "representativeness" of the sample is a comparison of the number of different types of schools with the number of each type selected in the sample. Table 14 was constructed to make this comparison. Some of the types of schools have been grouped according to natural similarities to facilitate interpretation. An examination of this table reveals that the sample contains about the expected numbers in all categories except the smallest. However, here the departure from expected numbers is not great--being only one school.

TABLE 13

NUMBER OF STUDENTS ATTENDING NEGRO SCHOOLS, CATEGORIZED BY GRADE AND SIZE OF SCHOOL

Grade	Size of School				Totals
	1-199	200-499	500-999	1000-up	
Ninth (Freshman)	430	710	835	----	1,975*
Tenth (Sophomore)	388	542	1,032	617	2,579
Eleventh (Junior)	351	418	844	449	2,062
Twelfth (Senior)	227	331	653	415	1,626
Totals	1,396	2,001	3,364	1,481	8,242

*Ninth grade total enrollment low due to the fact that two senior high schools in the sample enrolled no students below the tenth grade.

Another index by which one may judge the quality of the sample is to compare it quantitatively with the total number of Negro students in the same grades in Florida schools during the same year. The 25 Negro schools enrolled 8,242 students in grades 9- 12. This represents 24 per cent of the number of Negro public schools, and 23 per cent of the total Negro enrollment in the same grades. On the basis of this and the foregoing data, it seems reasonable to suggest that the sample is representative of the population from which it was selected.

TABLE 14

NUMBER OF SCHOOLS OF EACH TYPE IN FLORIDA AND IN THE SAMPLE SELECTED SHOWN AS PER CENT OF TOTAL

Type of School	Number in Florida	Per cent of Total	Number in Sample	Per cent of Sample
K- 12	1	62	1	56
1- 12	64 (65)		13 (14)	
4- 12	1	3	0	4
5- 12	1 (3)		1 (1)	
6- 12	1		0	
7- 12	26	26	6	28
8- 12	2 (28)		1 (7)	
9- 12	3	3	1	4
10-12	6	6	2	8
Totals	105	100	25	100

Findings relative to science offerings--Negro

The science offerings of the Negro high schools are given in Table 15.

Of the 25 schools in the sample, 80 per cent offered general science; 96 per cent, biology; 64 per cent, chemistry; and 44 per cent, physics. Physical science was a subject taught in 48 per cent of the schools and advanced chemistry, the only other science subject taught, was offered in one school. The schools in the smallest size category concentrated their science curriculum on general science and biology; the larger schools offered

more extensive science course coverage. The least common element of the normal sequence of general science, biology, chemistry, and physics was the latter.

TABLE 15

SCIENCE OFFERINGS OF THE NEGRO SCHOOLS, CATEGORIZED BY SUBJECT AND SIZE OF SCHOOL

Subject	Size of School				Totals
	1-199	200-499	500-999	1000-up	
	13*	7*	4*	1*	25
General Science	11	6	3	0	20
Biology	12	7	4	1	24
Chemistry	4	7	4	1	16
Physics	3	3	4	1	11
Physical Science	8	2	2	0	12
Advanced Chemistry	0	1	0	0	1

*The total number of schools in the category.

Table 16 was constructed to disclose the trends, if any, that exist relative to school size and variety of course offerings.

The largest school size category offered an average of three different science courses, whereas, the smallest offered just about the same number. Inasmuch as the smallest school size group consisted of 13 members and the largest

only one, it seems reasonable to place confidence in measures derived from the former and to be somewhat skeptical of the latter. Consequently, if we limit an interpretation of Table 16 to the first three enrollment categories, it is clear that the largest schools offer a more comprehensive science curriculum. The average number of different science courses for the three groups in order of school size was 2.92, 3.72, and 4.3.

TABLE 16

AVERAGE NUMBER OF DIFFERENT SCIENCE COURSES OFFERED IN THE NEGRO HIGH SCHOOLS, ARRANGED ACCORDING TO TYPE AND SIZE OF SCHOOL

Type of School	Size of School				Average
	1-199	200-499	500-999	1000-up	
K- 12	—	4	—	—	4
1- 12	2.92	—	—	—	2.92
5- 12	—	5	—	—	5
7- 12	—	3.3	4.3	—	3.8
8- 12	—	4	—	—	4
9- 12	—	3	—	—	3
10-12	—	—	4	3	3.5
Average	2.92	3.72	4.3	3	

An analysis of the data sheets reveals that five schools alternate the yearly offering of chemistry and physics; this represents 20 per cent of the schools

surveyed--the practice being the most common in the smallest school size category.

An analysis of Table 17, in which the access[2] to the science courses in the Negro high schools is expressed, reveals that 99 per cent of the Negro students could have elected to take a course in biology, the course being unavailable to 7 per cent of the students in the smallest school size category. Access to general science was almost as great as biology--only 6 per cent of the Negro students were denied such an offering. Twelve per cent of the students could not elect chemistry and 26 per cent could not elect physics. It is interesting to note that access to biology, chemistry, and physics in the three largest school size categories was 100 per cent. It is obvious, therefore, that the deficiency in the over-all access was the product of relatively low access in the smaller schools.

Fifty-two per cent of the students enrolled in the smaller schools could not take advantage of a three year science curriculum, whereas, all of the students in the schools enrolling 500 or more had this opportunity. Access to a conventional four year science curriculum was

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[2]The meaning of access and the method by which it is derived have been explained previously. The reader is referred to pages 31-32 for details.

37 per cent and the access to a five year program was 12 per cent. No Negro school in the sample offered more than five science courses.

TABLE 17

ACCESS TO THE SCIENCE COURSES IN THE NEGRO HIGH SCHOOLS, EXPRESSED AS PER CENT

Subject	Size of School				All Schools
	1-199	200-499	500-999	1000-up	
General Science*	96*	87*	100*	--	94*
Biology	93	100	100	100	99
Chemistry	33	100	100	100	88
Physics	29	100	100	100	74
Physical Science	50	26	48	0	35
Any three sciences	48	57	100	100	81
Any four sciences	19	57	48	0	37
Any five sciences	0	12	23	0	12

*Data figured only on the basis of those schools having a ninth grade.

Additional data relative to science enrollments are given in Table 18 in which the number of science class sections in the Negro schools, their total enrollment, and the average size of science classes are grouped according to school size. Of the 5,801 students taking one or more science courses, 40 per cent were enrolled in schools of

TABLE 18

THE NUMBER OF SCIENCE CLASS SECTIONS IN THE NEGRO SCHOOLS, THEIR TOTAL ENROLLMENT, AND THE AVERAGE* SIZE OF SCIENCE CLASSES, GROUPED ACCORDING TO SCHOOL SIZE

Subject	Size of School				Totals
	1-199	200-499	500-999	1000-up	
General Science:					
Sections	14	15	18	0	47
Enrollment	313	453	588	0	1,354
Average	22	30	33	—	29
Biology:					
Sections	14	20	35	21	90
Enrollment	379	603	1,030	630	2,642
Average	26	30	29	30	29
Chemistry:					
Sections	4	7	18	9	38
Enrollment	79	182	520	288	1,069
Average	20	26	29	32	28
Physics:					
Sections	3	2	8	1	14
Enrollment	62	30	214	28	334
Average	21	15	27	28	24
Physical Sci.:					
Sections	8	2	8	0	18
Enrollment	155	64	158	0	377
Average	19	32	20	—	21
Others:					
Sections	0	1	0	0	1
Enrollment	0	25	0	0	25
Average	—	25	—	—	25
Total Science Enrollment	988	1,357	2,510	946	5,801
Total Science Sections	43	47	87	31	208
Average Size	23	29	29	31	28

*Shown to nearest whole number.

less than 500 students, 42 per cent were taking courses in schools enrolling more than 500 but fewer than 1,000, and the single school larger than 1,000 students accounted for 16 per cent of the science enrollment. It is of interest to note that the 13 smallest schools had almost the same science enrollment as the largest school.

Twenty-three per cent of the science enrollment was in general science, 45 per cent in biology, 18 per cent in chemistry, and 6 per cent in physics. The enrollment in physical science was somewhat greater than in physics.

The average science class size in the Negro schools seems to be a function of school enrollment--the larger the school, the greater the enrollment per science section. This trend is disclosed by an examination of the following excerpt from Table 18, in which the average science class size is compared with school size.

Subject	Size of School			
	1-199	200-499	500-999	1000-up
General Science	23	26	32	32
Biology	23	28	31	29
Chemistry	18	22	24	24
Physics	17	18	24	24

It is noted that in only three cases is the average class size greater than the 30 students commonly agreed

upon by science educators as maximum class size. However, these means can be misleading as they may disguise the absolute frequency of over-crowding.[3] In order to test this suggestion, Table 19 was constructed; the number of science class sections having an average enrollment that equaled or exceeded 31 students was compared to the number of sections in each school size category for the five most popular subjects.

TABLE 19

THE NUMBER OF SCIENCE CLASS SECTIONS IN WHICH THE AVERAGE ENROLLMENT EQUALS OR EXCEEDS THIRTY-ONE STUDENTS COMPARED TO THE NUMBER OF SECTIONS, ARRANGED ACCORDING TO SCHOOL SIZE, FOR THE FIVE MOST POPULAR SCIENCE SUBJECTS

Subject	Size of School							
	1-199		200-499		500-999		1000-up	
	T	O	T	O	T	O	T	O
General Science	14	0	15	8	18	13	0	0
Biology	14	7	20	2	35	21	21	0
Chemistry	4	0	7	2	18	6	9	9
Physics	3	0	2	0	8	2	1	0
Physical Science	8	1	2	1	8	0	0	0
Totals	43	8	46	13	87	42	31	9

T = totals/O = overload

[3]This point is discussed in greater detail on pages 39 and 40.

A comparison of Table 19 with the excerpt from Table 18 reveals that the over-crowding in the Negro science classrooms is not as small as Table 18 suggests. According to the data in Table 19, as many as 72 science sections out of 207 may have been over-crowded--29 per cent. The fact of the matter is this figure represents the greatest possible amount of over-crowding and in all likelihood the actual incidence is somewhat less. Crowding is most common among schools enrolling 500-999 students--the possibility of occurrence in this group being roughly twice that of any of the other size categories. It seems reasonable to state that over-crowded science classes do not characterize the sample but its frequency is great enough to admit serious concern for the matter, since over-crowding is not tenable under any circumstances.

Table 20 shows, by per cent, the enrollment in the Negro science classes compared to total school and grade enrollment. According to these data, 70.5 per cent of all the students in the 25 Negro schools were taking a course in science, and more students in the next to the largest school size category were enrolled in a science course than any of the others. The table reveals that 20 per cent of the students were enrolled in general science, 32.2 per cent in biology, 13 per cent in chemistry, and 4.1 per cent in physics. In both biology and chemistry, an interpretation

TABLE 20

ENROLLMENT IN NEGRO SCIENCE CLASSES COMPARED WITH SCHOOL AND GRADE ENROLLMENT, RECORDED AS PER CENTS

Items	Size of School				All Schools
	1-199	200-499	500-999	1000-up	
Per cent of total enrollment in:					
Science classes	70.6	67.5	74.6	63.8	70.5
General science	22.4	24.8	17.5	0 +	20.0≠
Biology	27.2	30.0	30.6	42.5	32.2
Chemistry	5.3	9.1	13.9	19.4	13.0
Physics	4.4	1.5	6.4	1.9	4.1
Other Sciences	11.1	4.4	4.7	0	4.9
Per cent of freshman class in general science*	72.8	64.0	70.5	0 +	68.5≠
Per cent of sophomore class in biology*	97.6	111.0	99.9	102.0	103.0
Per cent of junior class in chemistry*	22.5	43.5	61.7	64.3	51.7
Per cent of senior class in physics*	27.3	9.1	32.8	4.3	20.5

*These figures may be slightly skewed due to the fact that enrollment is not limited to class. Some seniors, for example, take junior courses.

+Only school in this category was a three year senior high school; it offered no general science.

≠These averages computed by using data from first three categories.

of Table 20 suggests that the portion of total enrollment varies directly as school size; this is particularly noticeable in chemistry. Biology is a required subject in many of Florida's high schools and is commonly taken by students in the tenth grade. According to Table 20, 103 per cent of the sophomores enroll in this course--obviously some students in other classifications were also taking biology. Chemistry, traditionally a junior course, enrolled 51.7 per cent of the eleventh grade and physics, commonly a senior subject, accounts for 20.5 per cent of the twelfth grade. Though variation among the groups is not great, the data suggest that more students in the second largest size category take more than one science course than do students in the other schools.

Summary of enrollments and course offerings--Negro

The random sample, composed of 25 Negro public high schools, enrolled a total of 8,242 students and represented 23 per cent of Florida's total Negro school enrollment, grades nine through 12, during the 1958-59 academic year. Eighty per cent of these schools had enrollments of fewer than 500 students, 52 per cent less than 200, and 16 per cent enrolled between 500 and 999. One school had an enrollment of more than 1,000--1,481 to be exact. This one school enrolled more students than did the 13 schools

enrolling less than 200. The 11 schools in the other two size categories enrolled the bulk of the sample population --65 per cent.

In terms of how many schools in the sample offer a given course, biology was, by far, the most common--24 of the 25 schools offered it. The next most frequently occurring course was general science (20), followed by chemistry (16), physical science (12), and physics (11). The above frequencies when analyzed with respect to student availability revealed that, had they so desired, 6 per cent of the students were unable to take a course in general science; 1 per cent could take no biology; 12 per cent no chemistry; 26 per cent no physics; and 65 per cent no physical science. A three course science sequence was open to 81 per cent of all students and a four year program open to 37 per cent. Twelve per cent of the Negro students were enrolled in schools offering five different science courses--no school in the sample offered more. As a rule, the larger schools had more comprehensive science offerings.

Of the 8,242 students attending schools sampled, somewhat more than 70 per cent (5,801) were taking one or more science courses and, of these, 45 per cent were taking biology; 23 per cent, general science; 18 per cent, chemistry; 6.5 per cent, physical science; and 5.8 per cent, physics.

Limiting science class size to 30 students, it was found that no more than 29 per cent of the science classes could have been larger. The top figure is less than 72 sections out of 208.

Summary of enrollments and course offerings--all schools

The random sample, composed of 81 public high schools, represented 25 per cent of the public secondary schools operating in the state of Florida during the 1958-59 academic year. Three-fourths of the schools had enrollments of less than 500 and nearly one-half of them enrolled fewer than 200; six of the 81 schools had enrollments of 1,000 or more. The high schools visited had a combined enrollment (grades 9- 12) of 29,315 students, approximately 15 per cent of the corresponding school population of the entire state. Two-thirds of them attended schools enrolling more than 500; schools enrolling fewer than 200 accounted for nearly one-seventh of the sample population.

During the 1958-59 academic year, 75 per cent of the 81 schools offered general science; 97 per cent, biology; 68 per cent, chemistry; and 59 per cent, physics. In 1956, the percentage of the nation's schools offering the same respective science courses was 85, 90, 64, 57 (20, p. 6). It is seen, therefore, that Florida very slightly exceeded the national norms.

The number of different science courses offered was found to be related to school size--usually, the larger a school, the more extensive its offerings. However, it was also found that the larger schools had the largest science classes. Over-crowding (science classes with more than 30 students) was not common. The average science class enrollment arranged according to school size (smallest category to largest) was as follows: 21, 26, 29, and 30; average science class size for all schools was 27. Thus, the average science class in Florida during 1958-59 was somewhat smaller than the 30 students commonly recognized as a limit.

During the same period, the average class size in each of the sciences was found to agree very closely with the national averages (20, p. 20).

About 65 per cent of the students attending the high schools were found to be enrolled in one or more science classes. Biology, the most popular science course, enrolled nearly 31 per cent of the students; general science enrolled 20 per cent; chemistry, 11 per cent; and physics, 5 per cent. A comparison of these statistics with the 1956 national averages (20, p. 9) disclosed that Florida exceeded the national averages in biology and chemistry by 10 and 3 per cent, respectively, and just about equaled the figures for general science and physics.

By comparing the number of students in each of the four regular science courses with the total enrollment in the grade in which the course is usually offered, it was found that 72 per cent of freshman classes were enrolled in general science, 94 per cent of sophomores in biology, 41 per cent of juniors in chemistry, and 22 per cent of seniors in physics. A comparison of these amounts with national figures reveals Florida to have excelled in general science, biology, and chemistry by 5, 18, and 6 percentage points, respectively; in physics, Florida fell behind by 2 per cent (20, p. 12).

A relationship between school size and science enrollments was noticed. The proportional enrollment in biology and chemistry tended to increase as school size; the converse was found to be true for physics.

III. EQUIPMENT AND FACILITIES

Introduction

The knowledge relative to the individuality of the human organism suggests that the teaching-learning environment be constructed in such a manner that the needs of each individual may be met. In order to do this, a teacher exercises professional skill and strives to establish a situation or situations in which it is hoped growth is optimum. The teacher knows that the perceptions of an individual are an intensely personal affair and that education is a function of perceptions and their change. Provisions are made, therefore, so that perceptions may become palpable and, if necessary, changed. To do this, the teachers select from a broad spectrum of possibilities the educative processes judged to be the most productive.

Science teachers are particularly fortunate, for their subject lends itself well to a variety of treatments. Unfortunately, the free exercise of a teacher's choice is often constrained because of the limitations imposed by the school's facilities and/or equipment. Frequently, the educational alternatives exposed by these limitations are so far removed from preference that their use is questionable. Extensive facilities and equipment do not by

themselves assure the success of an educational process; they do, however, provide a context--a framework in which a large number of choices may be made and thus more likely provide for the many individuals sharing in the process.

The author realizes that what a school provides in the way of facilities and equipment is in large measure determined by the particular curriculum it offers and that evaluations should take this into consideration. Yet, each school should strive not only to meet the minimum specifications prescribed by local authority but to extend its present accouterment to provide for the greatest possible range and depth.

The facilities provided for science teaching may be very meager or very extensive--no one knows what the maximum provisions are or what they should be. On the other hand, the experts in the field of school administration and science education suggest that certain general elements be provided in high schools that offer science courses. The items selected for analysis in this dissertation are those that the author has derived from expert concensus. To make this selection, the author consulted the publications of several recognized experts or groups of experts and elected those items about which significant agreement was judged to exist (the reader is referred to the bibliography). This process resulted in

the following list of general facilities which, on the basis of their selection, are recommended as desirable features in high schools in which science is taught.

1. A lecture-demonstration desk should be in each science classroom.
2. Science areas should be provided with electrical, water, and gas outlets.
3. Science areas should have separate storage for chemicals and/or valuable equipment.
4. Space should be available for storage and preparation.
5. Audio-visual aids should be available for each science room.
6. Science areas should have adequate lighting, ventilation, and health and safety measures.
7. Live animals and plants should have facilities with suitable living conditions.
8. Science teacher should have a separate office.
9. Science facilities should include provisions for students to use published materials.
10. The library titles in the pure and applied sciences (Dewey Decimal 500 and 600 series)

should aggregate at least 20 per cent of the total.

The compilation of the data and its analysis was motivated by the foregoing recommendations, and the extent to which a school was able to subscribe to them was taken to be a measure of "quality."

Findings pertinent to science teaching facilities

Information pertinent to this category was analyzed with respect to the types of rooms in which instruction was given; presentation, laboratory, and certain miscellaneous facilities; and general observations on science teaching facilities. The data from white and Negro schools were treated independently.

In order to compare the school size categories on the basis of compliance with respect to the items selected for analysis in this chapter, a "performance index" was derived. The performance index was taken to be the measure of the extent to which a group met an arbitrary commitment (the elements selected for inspection in a given table). A performance index of 100 indicated that each school in the category complied with each item under consideration. To arrive at the performance index, the sum of the vertical responses for a given category was divided by the maximum possible response; the quotient obtained was then multiplied by 100.

A compilation of the data relative to the types of science classrooms is shown in Tables 21-W and 22-N (W-white, N-Negro). Interpretation of these tables discloses the following:

1. About one-fourth of the white schools had no science room available--a regular classroom was used for science instruction. This practice was most common in the smallest schools.
2. Nearly one-half of the white schools had combined classrooms and laboratories for one or more science areas, the relative frequency of this occurrence being greater in the larger schools.
3. One-sixth of the Negro schools had no science room available, this practice being limited to the smallest school category.
4. Combination classrooms and laboratories for one or more science areas were utilized in four-fifths of the Negro schools, this practice being more common in the larger schools.

The number of schools in which certain science presentation facilities were observed is shown in Tables 23-W and 24-N. It was found that 85 per cent of the white

TABLE 21-W

NUMBER OF WHITE SCHOOLS IN WHICH VARIOUS TYPES OF ROOMS WERE USED BY SCIENCE CLASSES

Types of Rooms	Size of School and Number in each Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Separate classroom and lab; one science area	0	0	0	1	1
Combination classroom and lab; one science area	4	3	2	4	13
Regular classroom; no science room available	10	1	3	1	15
Separate classroom and lab; two or more science areas	9	4	3	0	16
Combination classroom and lab; two or more science areas	8	7	5	1	21
Regular classroom; movable lecture-demonstration table	1	1	1	1	4

TABLE 22-N

NUMBER OF NEGRO SCHOOLS IN WHICH VARIOUS TYPES OF ROOMS WERE USED BY SCIENCE CLASSES

Types of Rooms	Size of School and Number in each Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Separate classroom and lab; one science area	0	0	1	0	1
Combination classroom and lab; one science area	3	4	4	0	11
Regular classroom; no science room available	4	0	0	0	4
Separate classroom and lab; two or more science areas	2	1	1	1	5
Combination classroom and lab; two or more science areas	5	3	1	1	10
Regular classroom; movable lecture-demonstration table	0	0	0	0	0

TABLE 23-W

NUMBER OF WHITE SCHOOLS IN WHICH CERTAIN SCIENCE PRESENTATION FACILITIES WERE OBSERVED

Facility	Size of School and Number in each Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Lecture-demonstration desk or table	23	11	9	5	48
Running water in room	25	12	8	4	49
Gas outlet	24	12	8	5	49
A.C. elec. outlet	26	11	10	5	52
D.C. elec. outlet	4	1	0	2	7
Fume hood	2	3	3	5	13
Compressed air outlet	0	0	0	2	2
Bulletin board	27	12	8	4	51
Room can be darkened for projection purposes	18	5	7	5	35
Motion picture projection equipment is available	28	12	8	5	53
Slide projection equipment is available	25	12	8	4	49
Filmstrip projection equipment is available	29	12	8	5	54
Elevated seating or elevated lect.-demonstration desk	1	0	0	1	2
Chalkboard*	29	12	10	5	56
*sq.ft. per room	81.9	84.5	74.2	93.5	82.5
Performance index	64	67	62	82	66

*A minimum of 70 square feet was recommended.

TABLE 24-N

NUMBER OF NEGRO SCHOOLS IN WHICH CERTAIN SCIENCE PRESENTATION FACILITIES WERE OBSERVED

Facility	Size of School and Number in each Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Lecture-demonstration desk or table	6	7	4	1	18
Running water in room	9	7	4	1	21
Gas outlet	6	7	4	1	18
A.C. elec. outlet	12	7	4	1	24
D.C. elec. outlet	1	0	1	0	2
Fume hood	1	1	4	1	7
Compressed air outlet	0	0	0	0	0
Bulletin board	12	7	3	1	23
Room can be darkened for projection purposes	5	4	0	1	10
Motion picture projection eqpt. is available	9	6	4	1	20
Slide projection equipment is available	11	3	4	1	19
Filmstrip projection eqpt. is available	12	6	4	1	23
Elevated seating or elev. lecture dem. desk	3	0	2	0	5
Chalkboard*	12	7	4	1	24
*sq.ft. per room	70.3	92.5	107.4	84.0	88.3
Demonstration index	50	63	71	79	61

*A minimum of 70 square feet was recommended.

high schools had science rooms equipped with A.C. electrical outlets, running water, gas, lecture-demonstration desks, bulletin boards, and chalkboards. The corresponding figure for the Negro schools was 72 per cent. Although 95 per cent of the white schools had projection equipment available, only 62 per cent of them had science rooms which could be darkened; 80 per cent of the Negro schools had projection equipment available, but only 40 per cent of the rooms could be darkened. The data indicate a relationship with respect to school size, the largest schools meeting more of the items listed than the smaller schools; this was particularly true for the Negro schools.

Compilation of data pertaining to laboratory facilities is given in Tables 25-W and 26-N. These tables record the number of schools in which certain laboratory facilities were observed. According to these tables, A.C. electrical outlets, the most common laboratory provision, were supplied by 89 per cent of the white schools and 84 per cent of the Negro schools. Closed storage cupboards, the next most common provision, were found in 75 per cent of the white schools and 60 per cent of the Negro schools. About half of the white and Negro schools had available water, gas, open storage shelves, and separate storage and supply rooms. The larger schools met more of the 11 different provisions than the smaller

TABLE 25-W

NUMBER OF WHITE SCHOOLS IN WHICH CERTAIN SCIENCE LABORATORY FACILITIES WERE OBSERVED

Facility	Size of School and Number in each Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Water & sink or trough on each table or desk	10	9	5	4	28
Water & sink in room but not on each desk or table	14	7	6	5	32
Gas outlet on each table	11	10	7	3	31
Compressed air outlet available in room	1	0	0	1	2
A.C. elec. outlet in room	24	11	10	5	50
D.C. elec. outlet in room	2	1	0	3	6
Fume hood(s)	3	2	2	5	12
Window and wall shelves	12	7	4	4	27
Open reagent and/ or storage shelves	17	6	7	4	34
Closed storage cupboards	20	10	9	3	42
Separate storage and supply room	16	10	8	4	38
Student eqpt. lockers avail. in laboratory	8	6	4	4	22
Performance index*	43	53	52	75	48

*Based on 11 items. First item deleted.

TABLE 26-N

NUMBER OF NEGRO SCHOOLS IN WHICH CERTAIN SCIENCE LABORATORY FACILITIES WERE OBSERVED

Facility	Size of School and Number in each Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Water & sink or trough on each table or desk	3	5	3	1	12
Water & sink in room but not on each desk or table	6	3	4	1	14
Gas outlet on each table	3	5	3	1	12
Compressed air outlet available in room	0	1	0	0	1
A.C. elec. outlet in room	9	7	4	1	21
D.C. elec. outlet in room	0	0	1	0	1
Fume hood(s)	2	2	4	1	9
Window and wall shelves	3	2	3	1	9
Open reagent and/ or storage shelves	1	6	3	1	11
Closed storage cupboards	7	4	3	1	15
Separate storage and supply room	4	6	3	1	14
Student eqpt. lockers avail. in laboratory	2	4	1	1	8
Performance index*	26	52	66	82	42

*Based on 11 items. First item deleted.

schools; this was especially true of the Negro schools.

The number of schools which had certain miscellaneous science facilities is shown in Tables 27-W and 28-N. These data disclose that science periodical and reference materials were available in more than 72 per cent of the high school libraries but were not available in more than half of the science classrooms. Fewer than 10 per cent of the schools made provisions for the following: separate office space for personal use of the teacher, separate project room for student use, and an animal room.

The small schools did a noticably poorer job in meeting the miscellaneous items listed, as evidenced by the performance indices. The index range of the white schools was 29 - 47, whereas, the range for the Negro schools was 24 - 48. In only one case, for the largest Negro school, did the performance index exceed 50.

General observations on science teaching facilities are disclosed in Tables 29-W and 30-N. Adequate lighting and ventilation were judged to exist in 80 per cent or more of the school science classrooms and laboratories. About one-fourth of the Negro schools were judged to have adequate science stockroom storage facilities and to have science rooms in which minor enlargement and modernization were feasible. Some four out of every ten white schools were able to meet the same provision. With respect to

TABLE 27-W

NUMBER OF WHITE SCHOOLS IN WHICH CERTAIN MISCELLANEOUS SCIENCE FACILITIES WERE OBSERVED

Facility	Size of School and Number in each Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Separate office space for personal use of teacher	1	2	1	1	5
Preparation or teacher work room	4	3	1	2	10
Stock or store room easily accessible	18	11	8	5	42
Darkroom avail. for photography	6	6	5	4	21
Separate project room for student use	2	1	0	0	3
Periodical material avail. in classroom	9	2	6	1	18
Book reference material avail. in classroom	12	6	7	1	26
Exhibit cases	8	5	4	3	20
Plant growing room or greenhouse	3	0	2	0	5
Animal room or house	0	0	1	4	5
Safe A-V eqpt. storage space	17	11	9	5	42
Periodical & refer. material in Lib.	22	12	10	2	46
Percent of total Lib. Titles in 500 & 600 series*	8.8	8.3	12.8	10.9	10.6
Performance index	29	41	45	47	35

*Based on completed records from 35 schools. These data not utilized in determining performance index.

TABLE 28-N

NUMBER OF NEGRO SCHOOLS IN WHICH CERTAIN MISCELLANEOUS SCIENCE FACILITIES WERE OBSERVED

Facility	Size of School and Number in each Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Separate office space for personal use of teacher	1	0	0	1	2
Preparation or teacher work room	1	4	0	1	6
Stock or store room easily accessible	5	6	2	1	14
Dark room avail. for photography	2	3	2	0	7
Separate project room for student use	0	0	0	1	1
Periodical material avail. in classroom	6	4	1	1	12
Book reference material avail. in classroom	6	5	1	0	12
Exhibit cases	1	2	0	0	3
Plant growing room or greenhouse	1	0	3	0	4
Animal room or house	0	0	0	0	0
Safe A-V eqpt. storage space	6	5	3	1	15
Periodical & refer. material in Lib.	9	5	3	1	18
Percent of total Lib. Titles in 500 & 600 series*	10.5	16.1	12.6	9.0	14.6
Performance index	24	40	31	58	31

*Based on completed records from 8 schools. These data not utilized in determining performance index.

TABLE 29-W

NUMBER OF WHITE SCHOOLS ABOUT WHICH CERTAIN OBSERVATIONS CONCERNING SCIENCE TEACHING FACILITIES WERE RECORDED

Items	Size of School and Number in each Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Minor enlargement and modernization is possible	13	4	4	1	22
Lighting in classrooms is adequate	29	11	10	5	55
Ventilation in classrooms is adequate	27	10	8	5	50
Lighting in labs is adequate	25	10	10	5	50
Ventilation in labs is adequate	23	11	9	5	48
Stockroom storage facilities are adequate	13	4	5	3	25
Performance index*	81	77	84	92	82

*First item excluded.

TABLE 30-N

NUMBER OF NEGRO SCHOOLS ABOUT WHICH CERTAIN OBSERVATIONS CONCERNING SCIENCE TEACHING FACILITIES WERE RECORDED

Items	Size of School and Number in each Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Minor enlargement and modernization is possible	3	4	0	0	7
Lighting in classrooms is adequate	12	7	4	1	24
Ventilation in classrooms is adequate	12	6	4	1	23
Lighting in labs is adequate	9	7	4	1	21
Ventilation in labs is adequate	8	7	4	1	20
Stockroom storage facilities are adequate	2	3	2	0	7
Performance index*	66	86	90	80	76

*First item excluded.

these observations, the different white school groups fared about equally well, as evidenced by the relatively narrow performance index range--81 - 92. On the other hand, the smallest Negro schools were significantly below each of the other size categories on the performance index. This indicates that, as a group, the small Negro schools did not satisfy the items listed as well as the larger schools did.

The number of schools in which ratings were assigned to certain science teaching facilities is shown in Tables 31-W and 32-N. These ratings were made by the survey team with the cooperation of school officials. An examination of these tables reveals that about half of the schools were judged "poor" with respect to science facilities. Usually, this evaluation was more common among the smaller schools. As school size increased, the quality of science facilities improved. This fact is supported by a consideration of Tables 33-W and 34-N which show the total performance index; that is, the index based on all the items previously considered. In both the white and Negro schools, the total performance index was found to be directly proportional to school size. Usually, the difference between the largest and smallest white schools was not as great as in the largest and smallest Negro schools.

In more than half of all of the schools, the

TABLE 31-W

NUMBER OF WHITE SCHOOLS IN WHICH RATINGS WERE ASSIGNED TO CERTAIN SCIENCE TEACHING FACILITIES

Items	Size of School and Number in each Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Science facilities on the whole are:					
Good	4	0	1	0	5
Fair	5	8	5	5	23
Poor	20	4	4	0	28
Lab space per student is:					
Excessive	1	0	0	0	1
Adequate	10	2	3	0	15
Inadequate	18	10	7	5	40
Community resources-field trips are:					
Frequently used	1	2	1	0	4
Moderately used	15	4	2	1	22
Rarely used	12	5	5	4	26
Not used	1	1	2	0	4

TABLE 32-N

NUMBER OF NEGRO SCHOOLS IN WHICH RATINGS WERE ASSIGNED TO CERTAIN SCIENCE TEACHING FACILITIES

Items	Size of School and Number in each Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Science facilities on the whole are:					
Good	1	4	1	1	7
Fair	3	1	2	0	6
Poor	9	2	1	0	12
Lab space per student is:					
Excessive	0	0	0	0	0
Adequate	3	4	3	0	10
Inadequate	10	3	1	1	15
Community resources-field trips are:					
Frequently used	2	2	1	0	5
Moderately used	7	4	1	1	13
Rarely used	2	1	2	0	5
Not used	2	0	0	0	2

laboratory space was judged to be inadequate. It is interesting to note that this condition was recorded in all of the largest white schools but in only two-thirds of the smallest white schools.

TABLE 33-W

TOTAL PERFORMANCE INDEX BASED ON FORTY-THREE ITEMS (WHITE SCHOOLS)

	Size of School				
	1-199	200-499	500-999	1000-up	Totals
Total performance index	49	56	58	69	55

TABLE 34-N

TOTAL PERFORMANCE INDEX BASED ON FORTY-THREE ITEMS (NEGRO SCHOOLS)

	Size of School				
	1-199	200-499	500-999	1000-up	Totals
Total performance index	39	55	60	72	48

Less than 10 per cent of the white and Negro schools utilized no community resources (field trips, excursions, etc.). More than half of all the schools had science teachers who took advantage of this kind of off-campus facility moderately or frequently.

Summary of science teaching facilities based on the 81 schools in Florida surveyed

The most prevalent types of rooms used by high school science teachers were combination classrooms and laboratories equipped for one science, and combination classrooms and laboratories equipped for two or more science areas. In approximately one-fourth of the schools, science was taught in regular classrooms. Separate classrooms and laboratories for a single science course were used the least.

In the small high schools, the use of regular classrooms and combination classrooms and laboratories equipped for two or more science areas was found most popular. The larger schools tended to use more combination classrooms and laboratories equipped for a single science course.

Four out of every five high schools had the following presentation facilities in their science classrooms: chalkboards, A.C. electrical outlets, bulletin boards, picture projection equipment, running water, gas outlets, and a lecture-demonstration desk. Fewer than 20 per cent of the schools had science rooms containing elevated seating or elevated lecture-demonstration desks, D.C. electrical outlets, and compressed air outlets.

Seven to nine out of every ten high schools had the

following science facilities in their laboratories: A.C. electrical outlets, storage cupboards, and separate storage-supply rooms. Five to seven in ten had running water in laboratories but not on each desk or table, open reagent and storage shelves, gas outlets on each desk, running water and a sink or trough on each desk or table, and open shelves. Student equipment lockers and fume hoods were present in only 39.5 and 28.4 per cent, respectively, of the schools' laboratories. D.C. electrical outlets and compressed air outlets were available in laboratories in less than 15 per cent of the schools.

Large high schools, as a group, had better presentation and laboratory facilities than their smaller school counterparts.

In the above summarization, items were listed in the order of their decreasing availability.

An evaluation of science teaching facilities, made by each visitor after consultation with science teachers and/or administrators, showed that all high schools having enrollments of 200 or more had adequate lighting and ventilation in science classrooms and laboratories. In schools enrolling less than 200 students, all of them had adequate lighting and all except one had adequate ventilation. Eight out of every ten schools in this size group had adequate lighting and ventilation in their laboratories. Stockroom storage facilities were adequate

in 52 per cent of the 81 high schools. Laboratory space per student was adequate in only 31 per cent of the schools.

Location of science classrooms and laboratories was such that minor enlargement and modernization were feasible in 20 per cent of the high schools with enrollments of 500 and up, and in almost 43 per cent of the schools enrolling less than 500 students.

The overall rating of the high schools' science teaching facilities, compiled by the visiting committee member and the personnel in the schools visited was: "good" in 15 per cent of the schools, "fair" in 37 per cent, and "poor" in 48 per cent.

Findings on general provisions for science equipment

Data pertinent to this category were analyzed with respect to budgetary and procurement practices for science equipment and supplies, sources of funds and equipment other than those associated with regular school channels, and general observations on science equipment.

Data relating to high school science equipment budgets and practices are given in Tables 35-W and 36-N.

These tables disclose that an inventory of science teaching equipment and supplies was maintained in 59 per cent of the white and 80 per cent of the Negro schools. In both, the practice was found to be more common in schools of larger enrollments. Although 28 white schools

TABLE 35-W

NUMBER OF WHITE SCHOOLS IN WHICH CERTAIN PROVISIONS FOR SCIENCE EQUIPMENT WERE NOTED

Items	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Inventory of equipment and supplies maintained	12	9	7	5	33
Annual budget for purchase of equipment	10	10	4	4	28
1958-59 total allotments for equipment	(6)* $1,180	(10)* $3,210	(3)* $1,300	(2)* $1,900	(21)* $7,590
Compared with 1957-58, these amounts represent:					
Increases	2	4	4	3	13
Decreases	3	1	0	1	5
No change	4	5	0	1	10
Annual budget for purchase of supplies	9	8	3	4	24
1958-59 total allotments for supplies	(5)* $ 585	(8)* $1,575	(2)* $ 350	(2)* $1,340	(17)* $3,840
Compared with 1957-58, these amounts represent:					
Increases	2	1	3	3	9
Decreases	3	1	0	0	4
No change	3	6	0	1	10

TABLE 35-W continued

Items	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Students pay laboratory fees	2	1	6	1	10
Students deposit funds for breakage	1	0	2	1	4

*Number of schools in category for which a specific budget was listed.

TABLE 36-N

NUMBER OF NEGRO SCHOOLS IN WHICH CERTAIN PROVISIONS FOR SCIENCE EQUIPMENT WERE NOTED

Items	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Inventory of equipment and supplies maintained	9	7	4	0	20
Annual budget for purchase of equipment	7	1	3	1	12
1958-59 total allotments for equipment	(5)* $1,100	Unk.	(3)* $1,995	(1)* $ 400	(9)* $3,495

TABLE 36-N continued

Items	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Compared with 1957-58, these amounts represent:					
Increases	2	0	0	1	3
Decreases	0	1	2	0	3
No change	4	0	1	0	5
Annual budget for purchase of supplies	4	2	3	1	10
1958-59 total allotments for supplies	(4)* $ 320	(1)* $ 100	(3)* $1,645	(1)* $ 350	(9)* $2,415
Compared with 1957-58, these amounts represent:					
Increases	1	0	0	1	2
Decreases	0	0	2	0	2
No change	2	1	2	0	5
Students pay laboratory fees	2	0	1	0	3
Students deposit funds for breakage	0	0	0	0	0

*Number of schools in category for which a specific budget was listed.

reported an annual budget for science equipment, only 21 of them had the figures available. For the 1958-59 academic year, the average budget for equipment was found to be $361.00. Almost half the white schools reporting claimed that this budget was an increase over the preceding year. Inasmuch as the total science enrollment in the schools from which these data were obtained was 5,574 students, the average expenditure per student for equipment was found to be $1.36.

Seventeen of the 24 white schools reporting an annual budget for the purchase of science teaching supplies had records from which data could be obtained. The average expenditure for these schools on such supplies was $226.00; since these schools had a total science enrollment of 4,576 students, the average cost of supplies per student came to $0.84.

Data concerning the science equipment budget of the Negro schools for 1958-59 were obtained from nine of the 12 schools reporting such a budget. The average expenditure for this item came to $388.00. Only one-fourth of the schools reporting a budget indicated that it was an increase over the preceding year. The total science enrollment in these schools was found to be 3,263; inasmuch as these schools budgeted $3,495.00 for equipment, the average cost per student was $1.07.

Ten Negro schools indicated a science teaching supplies budget and nine reported data on this item. The average amount of money available per school was approximately $268.00. Better than half of the schools reported their 1958-59 budgets for the science supplies to represent no change from the preceding year. Since 3,415 students were enrolled for science courses in these schools and the total budget for science teaching supplies was $2,415.00, the average expenditure per student amounted to $0.71.

Members of the state committee who visited high schools disclosed that some schools in the sample not having budgets for science equipment and supplies used funds from other allotments to provide some of the needed items. The lack of detailed records made it virtually impossible to account for the amount thus expended.

The payment of laboratory fees was not common in the white or the Negro high schools; ten cases were reported in the former and three in the latter. Six of these were found in which schools having enrollments between 500 and 999. Breakage deposits were required in four white schools but in none of the Negro schools.

The number of schools using various plans for the purchase of science equipment is shown in Tables 37-W and 38-N.

TABLE 37-W

NUMBER OF WHITE SCHOOLS IN WHICH VARIOUS PLANS FOR PURCHASING SCIENCE EQUIPMENT WERE USED

Plans	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Each teacher orders directly from supply houses	0	4	0	2	6
Science Dept. Head orders for teachers	0	0	2	0	2
Prin. orders for teachers	5	3	3	0	11
Supt. orders for teachers	14	3	2	1	20
All orders are pooled & bids obtained	8	6	2	2	18
Orders processed through central purchasing agency	10	1	3	1	15
Contract made with one supplier	1	0	0	0	1

According to these data, more orders for science equipment were processed by superintendents and central purchasing agencies than by any of the other methods listed. Twenty per cent of the white schools reported that orders were handled by principals for the science teachers; 4 per cent of the Negro schools made the same notation. The requirement that teachers' orders be pooled

and then submitted for bids was the second most popular method for science purchases among the white schools; among the Negro schools, this method, though the third most popular, accounted for only four schools of the 25. With respect to the size categories, the methods used by the high schools for purchasing science equipment did not disclose any trends.

TABLE 38-N

NUMBER OF NEGRO SCHOOLS IN WHICH VARIOUS PLANS FOR PURCHASING SCIENCE EQUIPMENT WERE USED

Plans	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Each teacher orders directly from supply houses	2	0	0	0	2
Science Dept. Head orders for teachers	0	2	0	1	3
Prin. orders for teachers	1	0	0	0	1
Supt. orders for teachers	4	3	1	0	8
All orders are pooled & bids obtained	4	0	0	0	4
Orders processed through central purchasing agency	4	2	3	1	10
Contract made with one supplier	1	1	0	0	2

The reader's attention is drawn to the fact that the totals in any one column in Tables 37-W, 38-N, and the six that follow, may exceed the number of schools in one column. This is due to the fact that two or more of the items may have been selected by a given school.

The tabulation of data regarding the auxiliary sources of funds for science equipment is compiled in Tables 39-W and 40-N.

TABLE 39-W

NUMBER OF WHITE SCHOOLS RECEIVING FUNDS FOR PURCHASING SCIENCE EQUIPMENT FROM THE LISTED SOURCES

Sources	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Parent-Teacher Assoc.	6	2	3	0	11
Local service club	1	1	1	1	4
School benefit program or party	2	0	0	1	3
Adm. to exhibits & science fairs	0	0	0	0	0
Interested parent or citizen	2	1	0	0	3
Local scientific society	1	0	0	0	1
Local industry	0	2	1	0	3

TABLE 40-N

NUMBER OF NEGRO SCHOOLS RECEIVING FUNDS FOR PURCHASING SCIENCE EQUIPMENT FROM THE LISTED SOURCES

Sources	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Parent-Teacher Assoc.	2	1	0	0	3
Local service club	0	0	0	0	0
School benefit program or party	1	3	0	1	5
Adm. to exhibits & science fairs	0	0	0	0	0
Interested parent or citizen	0	0	0	1	1
Local scientific society	1	1	0	0	2
Local industry	0	0	0	0	0

These data disclose that the most common method of securing auxiliary funds for science equipment in the white schools was through the facilities of the Parent-Teacher Association--20 per cent of the white schools took advantage of this source. Nearly 7 per cent of the white schools were recipients of funds supplied by local service groups; 5 per cent of the white schools received funds from school benefits, local industry, and interested parents or citizens. Admissions to exhibits and science

fairs were the only source of outside funds not reported by the white schools. The smaller schools availed themselves of these sources with greater frequency than the larger schools.

The Negro schools used benefit programs or parties as their most common source of auxiliary science equipment money; 20 per cent of the schools claimed this source. The Parent-Teacher Association provided 12 per cent of these schools with funds and local scientific societies and interested parents provided the balance. No Negro schools reported that local service clubs or local industry supported them in this respect.

Tables 41-W and 42-N refer to the number of schools which were receiving borrowed and/or donated equipment. By far, the most common supply of donated equipment for the high schools was the federal surplus program; 27 per cent of the white schools and 17 per cent of the Negro schools took advantage of this agency. Doctors' offices and industry furnished equipment to about one-tenth of the white and one-fifth of the Negro schools. So few schools were using borrowed or donated equipment that a relationship between school size and its use was not apparent.

Data pertaining to time allotments are shown in Tables 43-W and 44-N.

According to these data, in approximately

TABLE 41-W

NUMBER OF WHITE SCHOOLS RECEIVING BORROWED AND/OR DONATED EQUIPMENT FROM THE LISTED SOURCES

Sources	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Institutions of higher learning	1	0	1	0	2
Hospitals	0	0	2	0	2
Doctors' offices	0	2	2	1	5
Professional societies	1	1	0	0	2
Industry	1	2	1	2	6
Garages	3	2	1	0	6
Filling stations	2	2	0	0	4
Stores	1	0	0	0	1
Govt. surplus property programs	4	3	5	3	15

85 per cent of the high schools surveyed, the science teachers were permitted no time for the maintenance of equipment. None of the schools in the largest size category allotted time for this purpose.

Officials in nearly 80 per cent of the schools gave their science teachers no time for setting up equipment and getting ready for demonstrations and laboratory work. In 16 per cent of the white and 12 per cent of the

Negro schools, the allotted weekly time for this purpose was four or more hours. No significant relationship between school size and preparation time was noticed.

TABLE 42-N

NUMBER OF NEGRO SCHOOLS RECEIVING BORROWED AND/OR DONATED EQUIPMENT FROM THE LISTED SOURCES

Sources	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Institutions of higher learning	1	1	2	0	4
Hospitals	0	1	2	0	3
Doctors' offices	1	2	2	0	5
Professional societies	1	0	0	0	1
Industry	2	1	2	0	5
Garages	1	0	2	1	5
Filling stations	1	0	1	0	2
Stores	0	0	1	0	1
Govt. surplus property programs	2	0	1	1	4

Some general observations on science equipment are shown in Tables 45-W and 46-N.

An examination of Table 45-W reveals that 59 per cent of the white schools had laboratory and demonstration

TABLE 43-W

NUMBER OF WHITE SCHOOLS IN WHICH SCIENCE TEACHERS WERE ALLOWED TIME FOR MAINTENANCE OF EQUIPMENT AND PREPARING FOR DEMONSTRATION AND/OR LABORATORY WORK

Weekly Time Allotment	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Number of hours allowed for maintenance of equipment was:					
None	25	10	9	5	49
One	0	1	1	0	2
Two	1	0	0	0	1
Three	0	0	0	0	0
Four or more	3	1	0	0	4
Number of hours allowed for preparing for lab. and demonstration work was:					
None	24	8	7	4	43
One	0	1	1	0	2
Two	0	0	1	0	1
Three	1	0	0	0	1
Four or more	4	3	1	1	9

TABLE 44-N

NUMBER OF NEGRO SCHOOLS IN WHICH SCIENCE TEACHERS WERE ALLOWED TIME FOR MAINTENANCE OF EQUIPMENT AND PREPARING FOR DEMONSTRATION AND/OR LABORATORY WORK

Weekly Time Allotment	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Number of hours allowed for maintenance of equipment was:					
None	12	5	3	1	21
One	0	1	0	0	1
Two	0	0	0	0	0
Three	1	0	0	0	1
Four or more	0	1	1	0	2
Number of hours allowed for preparing for lab. and demonstration work was:					
None	11	4	4	0	19
One	0	0	0	0	0
Two	2	0	0	0	2
Three	0	1	0	0	1
Four or more	0	2	0	1	3

TABLE 45-W

NUMBER OF WHITE SCHOOLS ABOUT WHICH CERTAIN OBSERVATIONS CONCERNING SCIENCE EQUIPMENT WERE RECORDED

Items	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Lab. and demonstration equipment was:					
All outdated	1	0	0	0	1
All fairly new	12	4	1	0	17
More outdated than new	9	5	6	1	21
More new than outdated	5	3	3	4	15
Lab. and demonstration equipment was:					
Well maintained	13	11	8	4	36
Indifferently maintained	11	0	1	1	13
Poorly maintained	2	1	1	0	4
Improvised equipment was utilized:					
Frequently	7	4	4	1	16
Moderately	4	5	4	2	15
Rarely	9	0	1	2	12
Not at all	9	3	0	0	12

TABLE 46-N

NUMBER OF NEGRO SCHOOLS ABOUT WHICH CERTAIN OBSERVATIONS CONCERNING SCIENCE EQUIPMENT WERE RECORDED

Items	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Lab. and demonstation equipment was:					
All outdated	2	0	0	0	2
All fairly new	3	4	2	1	10
More outdated than new	3	1	0	0	4
More new than outdated	4	2	2	0	8
Lab. and demonstration equipment was:					
Well maintained	6	6	4	1	17
Indifferently maintained	3	1	0	0	4
Poorly maintained	1	0	0	0	1
Improvised equipment was utilized:					
Frequently	5	1	3	1	10
Moderately	6	4	1	0	11
Rarely	1	2	0	0	3
Not at all	1	0	0	0	1

equipment judged to be fairly new or more new than outdated. In the remainder of these schools, the equipment was judged to be outdated or more outdated than new. Sixty-seven per cent had equipment judged to be well maintained; 77 per cent made some use of improvised equipment.

In 72 per cent of the Negro schools visited, it was judged that their laboratory and demonstration equipment was either all fairly new or more new than outdated; in the remainder, it was considered that their equipment was all outdated or more outdated than new. Seventy-four per cent of these schools were judged to have equipment well maintained; 96 per cent used improvised equipment to some extent.

The data in Tables 47-W and 48-N disclose the number of schools in which ratings were assigned to general equipment and supply provisions for schools in which certain science courses were taught during the academic year 1958-59. These ratings were made at the time of school visitation by school personnel and the members of the survey team.

Of the 55 white and 24 Negro schools in which biology was taught, the equipment and supplies for the teaching of this subject were judged to be poor in more than 60 per cent of them. On the other hand, in chemistry,

TABLE 47-W

NUMBER OF WHITE SCHOOLS IN WHICH RATINGS WERE ASSIGNED TO GENERAL EQUIPMENT AND SUPPLIES FOR TEACHING BIOLOGY, CHEMISTRY, PHYSICS, AND GENERAL SCIENCE

Items	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Equipment for teaching biology was:					
Good	0	0	2	0	2
Fair	9	5	1	5	20
Poor	20	6	7	0	33
Supplies for teaching biology were:					
Good	1	0	2	2	5
Fair	5	5	1	2	13
Poor	23	6	7	1	37
Equipment for teaching chemistry was:					
Good	2	2	0	4	8
Fair	6	7	5	1	19
Poor	5	1	5	0	11
Supplies for teaching chemistry were:					
Good	4	5	2	3	14
Fair	6	5	5	2	18
Poor	3	0	3	0	6
Equipment for teaching physics was:					
Good	0	0	1	1	2
Fair	4	4	2	1	11
Poor	9	6	6	3	24

TABLE 47-W continued

Items	Size of School and Number of each in Category				
	1-199 (29)	200-499 (12)	500-999 (10)	1000-up (5)	Totals (56)
Equipment and supplies for teaching general science were:					
Good	3	1	0	0	4
Fair	6	4	3	1	14
Poor	12	6	5	0	23

TABLE 48-N

NUMBER OF NEGRO SCHOOLS IN WHICH RATINGS WERE ASSIGNED TO GENERAL EQUIPMENT AND SUPPLIES FOR TEACHING BIOLOGY, CHEMISTRY, PHYSICS, AND GENERAL SCIENCE

Items	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Equipment for teaching biology was:					
Good	0	1	1	0	2
Fair	3	2	1	0	6
Poor	9	4	2	1	16
Supplies for teaching biology were:					
Good	0	1	1	0	2
Fair	2	1	0	0	3
Poor	10	5	3	1	19

TABLE 48-N continued

Items	Size of School and Number of each in Category				
	1-199 (13)	200-499 (7)	500-999 (4)	1000-up (1)	Totals (25)
Equipment for teaching chemistry was:					
Good	1	1	1	0	3
Fair	1	3	1	0	5
Poor	2	3	2	1	8
Supplies for teaching chemistry were:					
Good	1	1	1	0	3
Fair	1	2	1	0	4
Poor	2	4	2	1	9
Equipment for teaching physics was:					
Good	0	0	1	0	1
Fair	0	0	0	0	0
Poor	3	3	3	1	10
Equipment and supplies for teaching general science were:					
Good	0	1	1	0	2
Fair	3	3	0	0	6
Poor	8	2	2	1	13

the equipment and supplies were considered poor in one-half or less of the schools that taught the subject. Two-thirds of the white schools had physics equipment rated as poor, and more than half had the same rating for general science equipment and supplies.

Physics equipment in ten of the 11 Negro schools in which physics was taught was judged as poor. The rating for the general science teaching equipment and supplies in 62 per cent of the Negro schools teaching this subject was the same.

The ratings of science teaching equipment and supplies did not significantly improve with an increase in school size. This trend is just slightly suggested, and then only in the larger white schools.

Summary on general provisions for science equipment based on the 81 schools in Florida surveyed

Thirty-seven per cent of the 81 schools had specific annual budgets for the purchase of science equipment for the 1958-59 academic year; the total funds provided for these budgets was $11,085.00. Since 30 schools reported these budgets, the average amount per school was $369.50. Inasmuch as the total science enrollment in these schools was 9,837, the average expenditure per student for science equipment was $1.13.

Applying the above method to interpreting data on annual budgets for science supplies, the average amount expended per school was about $240.00; the average cost per student for such supplies, $0.78.

Inventories of science equipment were maintained by 65 per cent of the schools; students had to pay laboratory fees in 16 per cent and were charged a breakage deposit in 5 per cent.

The most frequently used procedure for buying science equipment was to place orders with school superintendents and central purchasing agencies which in turn completed the transaction; no less than 30 per cent of the schools reported this practice. The process of pooling orders and requesting bids was mentioned by 27 per cent of the schools. Only eight schools reported that science teachers ordered directly from supply houses.

Funds for the purchase of science equipment from out-of-school sources were reported by some of the schools. The Parent-Teacher Association was the most frequently utilized source of this money.

The use of borrowed and donated equipment was relatively limited. However, about one-fourth of the schools took advantage of government surplus property programs. Nearly one-eighth secured equipment from doctors' offices, industry, and garages.

Seven-eighths of the schools taking part in the study reported that their science teachers were given no weekly time allotment for the maintenance of science equipment; more than three-quarters had no such time for the preparation of laboratory or demonstration work.

Sixty per cent of the schools were judged to have science equipment classified as "all fairly new" or "more new than outdated." The balance had equipment classified as "more outdated than new" and "all outdated."

Improvised science equipment was used to some extent by 84 per cent of the schools. More than one-third of these claimed to use this kind of equipment frequently.

An evaluation of science equipment was made by each high school visitor with the acknowledgment of school science personnel or administrators at the time of the visitation. These overall evaluations, rated on "good," "fair," or "poor," were tabulated only for those schools in which the given science was taught during the academic year 1958-59. Physics equipment, for example, was not rated in those schools not teaching the subject. On the basis of these judgments, the quality and quantity of science equipment in the schools visited, ranked in descending order, was found as follows: chemistry, general science, biology, and physics.

Findings pertinent to quantity of equipment

The data in the equipment inventories in this study were utilized to determine the number of schools in which the listed items of equipment were available and the quantity of each item available for those schools that offered one or more of the following sciences during the academic year 1958-59: general science, biology, chemistry, and physics.

The equipment lists were prepared to serve as guides for inventory and tabulation purposes. The lists are not closed--there are many possible items not included. Furthermore, the lists are not mutually exclusive; some items may be used in the teaching of one or more of the sciences.

As a basis for item selection, it was decided that the inventory should be comprehensive enough to enable the high schools to offer effective science instruction both in the classroom and in the laboratory. Koelsche, the author of the equipment inventory (see Chapter I), based his selection on the foregoing reason and consulted the recommendations of many experts in the field of science education before final choice was made. The bibliography includes many of these sources and the reader is referred to them for further elaboration.

In an effort to estimate the extent to which the

Florida schools were supplying the items of equipment for science instruction, the most exhaustive list of recommended apparatus for such purposes that the author could find was used as a guide: The Purchase Guide for Programs in Science, Mathematics, Modern Foreign Languages (17), published under the auspices of the Council of Chief State School Officers. In this volume, the several hundred items listed for use in teaching general science, biology, chemistry, and physics are categorized as either basic, standard, or advanced. According to the Council, the basic items should be found in every modern classroom and laboratory, and are required for minimum programs for science instruction. The standard items are those which enlarge upon the basic list and expand the scope of the science program, and the advanced list of items is recommended for specialized purposes only after the basic and standard items have been procured. Upon comparison, it was found that 60 per cent of the items appearing on the equipment inventory used in this study also appeared in the Purchase Guide under the category of basic; another 20 per cent appeared in the remaining two categories. Using the basic list as a criterion, it is clear that one would expect to find a significant number of the items listed in the inventory in each of the Florida schools surveyed.

An examination of Tables 49-W through 56-N (see Appendix III), in which the data relative to the quantity of equipment are recorded, reveals that the schools offering science courses had little of the equipment listed. From a list of 33 items commonly used in general science classrooms, only two of the items were found in more than half of the white schools in which that subject was taught; there was no item on the list possessed by more than half of the Negro schools.

In order to expose the situation in regard to the availability of equipment, an "equipment index" was derived according to the procedure discussed elsewhere in this chapter (see page 67). An equipment index of 100 indicated that each school teaching the course under consideration had all of the items of equipment for the course that were listed in the inventory.

The general science equipment index for the white schools was found to be 16.0 and for the Negro schools, 10.9. In both groups, the equipment index was found to be the least for the smallest schools.

The biology equipment inventory contained 50 items, 15 of which were present in more than half of the white high schools in which the subject was taught; 23 of the items were present in half or more of the Negro schools in which biology was taught. The biology equipment index

for the Negro schools was 40.0 and for the white, 35.7. In both groups, the smallest schools had the smallest equipment indices.

The equipment inventory for chemistry was composed of 71 items, 48 of which were reported to be present in half or more of the white schools in which chemistry was taught; 22 of the items were present in half or more of the Negro schools in which the subject was taught. The chemistry equipment index for the white high schools was found to be 55.2 and for the Negro schools, 39.5. The paucity of chemistry equipment was most noted in the smallest schools.

Two hundred twenty-eight items were listed on the physics equipment inventory and 46 of them were reported in half or more of the 37 white schools in which physics was taught; only 9 of the items were reported to be present in half or more of the Negro schools teaching the same subject. The physics equipment indices were calculated to be 32.1 and 17.2 for the white and Negro schools respectively. The greatest shortage of physics equipment was found to exist in the smallest schools.

On the basis of the equipment indices, the ranked order of availability of science equipment (shown in descending order) was as follows: chemistry, biology, physics, and general science.

IV. ACADEMIC BACKGROUND OF THE SCIENCE TEACHERS

Introduction

One argument that critics of American education frequently offer is in regard to teacher preparation; they claim that teachers are "weak" in the subject areas in which they teach and that the college background of teachers is limited. They offer any one or more of the following suggestions to account for this occurrence: teachers as a group simply do not want to become erudite in their field of study--teaching is not a primary professional choice and, therefore, results in a "second-class" effort; teachers are not intellectually able to pursue an academic life--state certification requirements do not encourage academic rigor. These assertions may or may not be valid. It is quite likely that some of them apply to some teachers, but most unlikely that generalizations such as these include even "most" teachers. The question here, however, is not "why?" but rather, "Do Florida's science teachers fall short of having the necessary academic background?" It is not the purpose of this study to appraise the quality of Florida's requirements for the certification of science teachers, but to ascertain if the teachers conform to these requirements and to what extent

they may be exceeded. This may load the critics with more ammunition. On the other hand, it may force them to realize that the picture may not be as black as they have been painting it.

Prior to conducting this research, the author assumed that the facilities and equipment for science teaching in Florida were not sufficient for the task. This hypothesis was supported by the findings of the previous chapter. Naturally, this work does not establish the truth of such a notion but it does offer a measure of greater confidence in it. Now, it may be that a particular teacher sees his situation from a point of view different from that of a "foreign" observer; indeed, this is quite likely. An individual teacher may thus refute the findings of investigators. If this occurrence is rare, then the expected has occurred and our faith in our findings is not significantly diminished. If, on the other hand, conflicts of this kind are common, then the observer is forced to reconsider his criteria and his evidence.

It may be that the science teachers in the schools visited do not substantiate the findings in Chapter III; they may perceive that their facilities and equipment are equal for the task. If it is found that these teachers confirm the findings, we are permitted more confidence in them. This concensus puts us in a stronger position to justify specific recommendations.

If, on the other hand, the findings are negated by the teachers, then it may be that the author's assumptions regarding equipment and facilities were fallacious, and that these factors do not bear the significance that the author has attached to them.

It is also important to ascertain how the science teachers perceive themselves. Do they see themselves in need of more science content? If it is found that they do, then the need for revising or amending programs of teacher education and/or in-service training becomes more apparent.

In order to investigate teacher perceptions, a "frontal-attack" was made on them by using a questionnaire (see Appendix IV). It was assumed that an analysis of responses to certain direct inquiries would reveal their feelings. The members of the school visitation staff distributed these instruments and a stamped, addressed return envelope to the science teachers in each school they visited. In order to encourage frank responses anonymity was promised and no identifying features were put on either the questionnaires or the return envelopes. The teachers were requested to complete them at their leisure and to return them before the completion of the school year. One hundred twenty-seven responses were received--63.5 per cent of the science teachers in the schools surveyed. No effort was made to establish the

composition of the responding group.

In order to examine the academic qualifications of all the science teachers in the 81 schools, it was necessary to first determine who they were and then to obtain their college transcripts and analyze them. Florida State Board of Education regulations require each school in the state to submit a yearly report for accreditation purposes. The forms for filing these reports are uniform and have been prepared by the Florida State Department of Education. In addition to other information, these reports contain the names of teachers, their schedules, their state certification, and salaries. The accuracy of the information submitted in these reports is attested by the signatures of both the principal of the individual schools and the County Superintendent of Public Instruction. These records were made available to the author by officials of the Research Services of the State Department. A form prepared by the author (see Appendix V) was used to facilitate the compilation of data. Once the names of the teachers, their schedules, and certifications were obtained, the college transcripts of these teachers were examined. These transcripts are a part of the permanent record of each person seeking certification in Florida.

The author recognizes that the analysis of the college transcripts which follows is not necessarily based on the most recent records. Many teachers have added to their academic backgrounds since making application for Florida Certification. It would have been better to have procured the "completed" transcripts of each teacher but, unfortunately, the financial resources available to the author would not permit this undertaking. It should be recognized, therefore, that the data presented here with respect to academic credits will not be entirely accurate; that is, the "real" figures may be somewhat more than the author's findings.

Florida certification requirements

There are several ways a person may qualify to be certified by the State Department as a science teacher. The excerpt below explains the usual requirements.

> Certification covering the broad field of science will require a minimum of 32 semester hours. Of this total, 8 semester hours may be obtained through comprehensive courses in biological and physical science. The remainder must be taken in separate subject courses which must include at least 8 semester hours in each of the following: (a) chemistry, (b) physics, (c) biology (botany and zoology), and if possible, one course in bacteriology.

> Certification in the separate fields of science.
> Fifteen (15) semester hours in the individual subject to be shown (such as biology, chemistry, or physics) are required, four of which may be earned in general comprehensive courses.
>
> Certification in general science.
> Twelve (12) semester hours are required which must include general biology and credit in physical science. (21)

General science may also be taught in ninth grade by persons not necessarily qualified as outlined above. Certification standards provide that certification in any one of several subject matter areas permits one to teach many subjects including general science at the junior high level; this includes ninth grade, the level in which the subject is commonly taught.

National science teacher qualification recommendations

Authorities in the field of science education agree that for prospective science teachers about one-half of the work for the Baccalaureate Degree be devoted to science courses. This recommendation is made in both the thirty-first (38) and the forty-sixth (39) Yearbooks of the National Society for the Study of Education. The American Association for the Advancement of Science Cooperative Committee on Science Teaching has consistently recognized this as a sound proposal (3, 45).

Using these recommendations as a standard and interpreting science to include mathematics, the academic backgrounds of the science teachers in the schools visited were evaluated. For the purpose of this appraisal, 60 semester hours (undergraduate and/or graduate) in science and mathematics were taken to represent "one-half of the work for the Baccalaureate Degree." This tended to give the teachers somewhat of an advantage over the specific recommendation of the NSSE and the AAAS.

Findings pertaining to the academic background of the science teachers

The data for these findings came from an examination of records on file with the Florida State Department of Education. Two hundred one science teachers[4] were found to be employed in the 81 schools visited. Of these, 141 were white and 60 were Negro. Of the white teachers, 87 were teaching full-time; 34 of the Negro science teachers were classified as full-time. The distribution of the science teachers with respect to race and whether full-time or part-time is shown in Table 57.

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[4]For purposes of this study, a full-time science teacher was considered to be one who taught only in the various fields of science; a part-time science teacher was one who taught one or more science classes and some non-science subject or subjects.

TABLE 57

THE NUMBER OF FULL-TIME AND PART-TIME SCIENCE TEACHERS IN THE SCHOOLS VISITED, CLASSIFIED ACCORDING TO RACE

	White	Negro	Total
Full-time	87	34	121
Part-time	54	26	80
Total	141	60	201

Using Florida Certification requirements as a standard, examination was made of the teachers' records to see if they were teaching in the fields of their certification. The results of this search are tabulated in Table 58.

Reference to this table reveals that one or more classes in science in grades 9- 12 was taught by 315 teachers and of that number 27 (8.6 per cent) were not fully certified to teach the science course taught. It is interesting to note that this figure agrees to the number with that of Sims (49) based upon a similar study made in the fall of 1957. Table 58 reveals that the relative frequency of certification violations occurred to the greatest extent in physics (14.5 per cent), followed in descending order by chemistry (13.6 per cent), biology (8.1 per cent), and general science (1.3 per cent). With respect to the science teachers, the part-time teachers

violated certification requirements to the greatest extent. Full-time Negro teachers had the smallest incidence of certification violations.

TABLE 58

THE NUMBER OF SCIENCE TEACHERS TEACHING CERTAIN SCIENCE COURSES AND THE NUMBER TEACHING OUTSIDE THEIR AREA OF CERTIFICATION, ARRANGED ACCORDING TO TEACHER LOAD (FULL-TIME, FT; PART-TIME, PT) AND RACE

Subject	Number of Science Teachers*								
	White				Negro				
	FT	87*	PT	54*	FT	34*	PT	26*	Totals
61+ Gen. Sci.	33		20		12		13		78
Violations		0		0		1		0	1
79+ Biology	55		32		25		11		123
Violations		1		4		2		3	10
55+ Chemistry	35		8		15		8		66
Violations		5		3		1		0	9
48+ Physics	23		12		8		5		48
Violations		5		2		0		0	7
Totals	146	11	72	9	60	4	37	3	315 27

*The number of teachers in the category.

+The number of schools in which the subject was taught.

From the foregoing, it is clear that some of the students in Florida's high schools were studying science subjects under the guidance of teachers not qualified by standards recommended by the state. The author made an attempt to ascertain the number of science students thus affected but this effort was met with frustration--the data did not lend itself to analysis. However, a very crude estimate of the number involved was obtained in the following way: 78 general science teachers taught the subject to 3,889 students--an average of 50 students per teacher. Since one general science teacher was not qualified to teach the subject, about 50 students were not being instructed by a certified teacher. Using this method for estimating, the respective numbers involved for biology, chemistry, and physics were 720, 432, and 189. Thus, the total estimate of students guided by non-qualified science teachers was 1,391--7.4 per cent of the total science enrollment in the 81 schools surveyed.

Tables 59, 60, 61, and 62 show the average science and mathematics background of the general science, biology, chemistry, and physics teachers in the 81 schools surveyed. To obtain these data, reference was made to the college transcripts of each teacher. When necessary, to facilitate

TABLE 59

THE AVERAGE SCIENCE AND MATHEMATICS ACADEMIC BACKGROUND IN SEMESTER HOURS OF THE GENERAL SCIENCE TEACHERS IN THE 81 SCHOOLS SURVEYED

		Biology	Chemistry	Physics	Other Science	Total Science	Mathe-matics	Total Sc. & Math.
	Number	Average	Average	Average	Average	Average	Average	Average
Full-time White	33	14	12	5	2	32	5	37
Part-time White	20	10	8	5	2	25	8	34
Full-time Negro	12	22	17	5	1	46	6	52
Part-time Negro	13	12	15	2	1	29	6	35
Total Teachers	78	14	12	4	2	32	6	38

TABLE 60

THE AVERAGE SCIENCE AND MATHEMATICS ACADEMIC BACKGROUND IN SEMESTER HOURS OF THE BIOLOGY TEACHERS IN THE 81 SCHOOLS SURVEYED

		Biology	Chemistry	Physics	Other Science	Total Science	Mathe-matics	Total Sc. & Math.
	Number	Average	Average	Average	Average	Average	Average	Average
Full-time White	55	25	10	5	2	42	5	46
Part-time White	32	16	9	4	2	31	7	37
Full-time Negro	25	21	15	4	2	43	6	49
Part-time Negro	11	18	11	3	0	32	6	38
Total Teachers	123	21	11	4	2	38	5	44

TABLE 61

THE AVERAGE SCIENCE AND MATHEMATICS ACADEMIC BACKGROUND IN SEMESTER HOURS OF THE CHEMISTRY TEACHERS IN THE 81 SCHOOLS SURVEYED

		Chemistry	Biology	Physics	Other Science	Mathe-matics	Total Science	Total Sc. & Math.
	Number	Average	Average	Average	Average	Average	Average	Average
Full-time White	35	20	12	8	2	8	42	50
Part-time White	8	19	8	7	2	15	36	50
Full-time Negro	15	16	20	5	2	7	43	50
Part-time Negro	8	19	13	5	0	13	37	50
Total Teachers	66	19	13	7	2	9	40	50

TABLE 62

THE AVERAGE SCIENCE AND MATHEMATICS ACADEMIC BACKGROUND IN SEMESTER HOURS OF THE PHYSICS TEACHERS IN THE 81 SCHOOLS SURVEYED

		Physics	Chemistry	Biology	Other Science	Mathe-matics	Total Science	Total Sc. & Math.
	Number	Average	Average	Average	Average	Average	Average	Average
Full-time White	23	9	17	21	2	8	49	58
Part-time White	12	10	6	7	3	15	25	40
Full-time Negro	8	7	14	19	2	11	41	52
Part-time Negro	5	5	15	14	0	10	34	43
Total Teachers	48	8	14	16	2	10	40	51

the acquisition of data and provide uniformity, college credits have been converted to semester hours. Thus, credits shown on transcripts in quarter hours have been multiplied by two-thirds to make the necessary conversion. Each table has been constructed to display the average academic background in the subject that the teachers teach and in certain other sciences and mathematics as well; the information is arranged according to full-time, part-time, and race.

Each table, therefore, serves as a convenient instrument for comparing the academic backgrounds of the teachers with the recommendations of the NSSE and the AAAS--namely, 60 semester hours in science and mathematics. It was not suggested by these organizations that the chemistry teacher, for example, have 60 hours of chemistry, but rather a concentration in chemistry supported by one or more strong minors in allied fields. Assuming 24 semester hours to represent a major and 15 hours a minor, the foregoing recommendations provide a balanced background--one which should be sufficient as a "starter," and which should permit access to further development. Thus, the biology teachers, for example, would be expected to have a major in biology consisting of no less than 24 semester hours, and one or more minors in science and/or mathematics (at least one in science), such that the

total is not less than 60 hours. The expectations for the chemistry and physics teachers are similar. The general science teachers should have a broad general background in science with no less than 12 hours in each of three different science subjects, plus additional science and/or mathematics to total the 60 hours.

The recommendations outlined above were used as criteria to judge the adequacy of the academic backgrounds in science of the general science, biology, chemistry, and physics teachers in the 81 schools surveyed.

Examination of Table 59 discloses the pattern of the average academic background of 45 full-time and 33 part-time white and Negro general science teachers. It is clear that these averages did not conform to the criteria previously suggested. Accordingly, these teachers were judged to be insufficiently qualified. They were strongest in biology and mathematics, averaging 14 and 12 semester hours, respectively; they averaged but four semester hours in physics. Of this group, the full-time Negro teachers were the best qualified; all of the other teachers had about the same qualifications. The data suggest that teachers of general science concentrated their science content on biology and chemistry; they usually took about two courses in physics and mathematics and most have had one course in another science.

Eighty full-time and 43 part-time white and Negro biology teachers have their average science and mathematics credits displayed in Table 60. As a group, 123 teachers did not average a major in biology or a minor in any other science and/or mathematics; the total average academic science and mathematics background for these biology teachers was 44 hours--16 less than the 60 recommended. Consequently, they were not adequately qualified as biology teachers. The 55 full-time white teachers had the strongest background in biology but this advantage was not significantly larger than the full-time Negro biology teachers. The data indicate that the full-time biology teachers were better prepared than the part-time teachers. The mathematics background for the biology group averaged about two courses.

Table 61 shows the preparation for the 50 full-time and 16 part-time white and Negro chemistry teachers. As a group, they averaged 19 semester hours in chemistry, 13 in biology, seven in physics, and nine in mathematics. The total average in science and mathematics for these 66 teachers was 50 semester hours. It is seen that this group did not completely satisfy the criteria previously outlined and were thus judged to be deficient. The chemistry teachers appeared to have remarkably uniform backgrounds and no significant trend was suggested.

The science and mathematics foundation of the 48 physics teachers is shown in Table 62. These people averaged eight semester hours in physics, 14 in chemistry, 16 in biology, and ten in mathematics. It would seem that these teachers were better qualified to teach any of these--except physics. Although, as a group, the science and mathematics total average of 51 hours approached the 60 hours enforced here as a standard, they were patently not adequately prepared as physics teachers; they most nearly met the description of general science teachers--lacking but a few courses to be eminently qualified in that respect.

Summary of academic background of science teachers

In terms of general scientific and mathematical background, the physics teachers had the most extensive foundation. Following this group in descending order were the teachers of chemistry, biology, and general science.

The biology teachers had the greatest depth in their subject but the chemistry teachers were a close second. Having less than half the average of either biology or chemistry teachers in this respect were the physics teachers--the group found to be the least qualified to teach.

As a group, the science teachers in the schools surveyed were insufficiently prepared as science teachers.

Findings pertaining to the perceptions of the science teachers

In order to test if the science teachers substantially agreed with the findings of the previous chapter, they were asked, "What seems to be the greatest difficulty that you encounter in your science classes?" An item analysis of the 201 discernible responses to this query was made by placing each response into one of the following five categories: (1) replies pertaining to insufficiencies (equipment, supplies, laboratories, etc.); (2) replies pertaining to the quality of students (slow learners, no grouping, sloppy study habits, student attitudes, etc.); (3) replies pertaining to time (lack of time for teachers to prepare, length of class period, no time provided for laboratory experiences, etc.); (4) replies pertaining to over-crowded conditions; and (5) replies pertaining to any other topic. It was found that 50 per cent of the replies related to insufficient facilities, 23 per cent related to the quality of the student, 17 per cent related to considerations of time, 5 per cent related to over-crowding, and the remaining 5 per cent related to several other topics.

Inasmuch as many of the respondees submitted more than one answer to the foregoing question, the relative significance of any response could have been distorted. Assuming that the first response offered by an individual is usually a reflection of intensity of perceptions, an item analysis of them was made. This consideration revealed that of the 125 initial responses to the question, 43 per cent were related to insufficiencies, 28 per cent were related to student quality, 12 per cent were related to time considerations, 9 per cent to over-crowding, and 10 per cent related to all other topics. In order to facilitate comparison of the two analyses, Table 63 was constructed.

TABLE 63

COMPARISON OF THE INITIAL RESPONSES AND ALL THE RESPONSES TO A QUESTION CONCERNING TEACHER DIFFICULTY IN SCIENCE CLASSROOM

Relative Frequency (Per Cent)--Initial Response	Category	Relative Frequency (Per Cent)--All Responses
43	Insufficiencies	50
28	Student quality	23
12	Time considerations	17
9	Over-crowding	5
8	All others	5

It is seen that the two groups have similar distributions. If the initial response indicated what teachers felt most intensely, it is obvious that the largest portion of them shared the same attitudes. The data indicate that more than 40 per cent of the teachers responding to the questionnaire perceived that the equipment and facilities with which they worked were inadequate. This difficulty was exposed as the domain of greatest teacher concensus; they substantially agreed with the findings of Chapter III.

In order to assay the feelings of teachers with respect to their own academic needs, they were asked to respond to the following: "Given the opportunity, what courses would you take to add to your competency as a teacher? Please list them in order of preference." It was assumed that an analysis of the responses to this question would reveal whether the teachers saw themselves in need of content in science or something else.

One hundred nine teachers listed a total of 294 specific selections of which 75.5 per cent represented science content. Inasmuch as the question imposed an ordered choice, the 109 first responses were also analyzed. To do this, the initial choice of each respondent was grouped according to science content, science education (methods), mathematics, and any other preference

was placed in one inclusive category. Science content accounted for 72.5 per cent of this distribution; science education, 12.7 per cent; mathematics, 6.4 per cent; and "all others," the balance. These statistics do not testify that the science teachers acknowledged weaknesses in their comprehension of science content (though this may have been so) but rather that science content was the background that they were desirous of reinforcing to help them do a better job in the classroom.

It is of interest to note that the particular branch of science most often mentioned by the teachers was biology--the area in which (with respect to academic foundation) they seem to be the most qualified. The reasons for this are not clear. Further research in this area is suggested.

Summary of findings related to teacher perceptions

From an analysis of responses to a questionnaire, the science teachers were found, (1) to feel that the lack of equipment and facilities for science instruction was a determent in their classrooms, and (2) that they were in need of additional subject matter content in science. Inasmuch as behavior is a function of how a situation is perceived, it is likely that the performance of Florida's science teachers will improve if the conditions mentioned here are rectified.

V. SURVEY SUMMARY

Introduction

The purpose of this study has been to survey certain selected provisions relative to science teaching in a 25 per cent random sample of the high schools in Florida during the academic year 1958-59. Three areas of concern were chosen for investigation: (1) science course offerings and enrollments; (2) the facilities and equipment used in teaching science; and (3) the academic qualifications of the science teachers. The collection of data was made by the author, independent of and in conjunction with, a survey team (of which the author was a member) selected to visit the high schools and complete itemized instruments relative to offerings and enrollments, and the facilities and equipment for science instruction. The data pertinent to the academic background of the science teachers were obtained from an analysis of their college transcripts. Additional information concerning the perceptions of the science teachers was secured from an analysis of their responses to a questionnaire.

Inasmuch as the Florida Department of Education provides for two distinct school systems, white and Negro, the detailed treatment of the data and the findings

has followed suit. However, over-all summaries based upon all schools have been included. This was done because the study was conducted in conjunction with the United States Office of Education and the University of Toledo as part of a seven state project (31), and uniformity of the treatment of the data was essential for comparisons between the several states involved in the study.

Summary of major findings

The major findings of this study are summarized as follows:

1. With respect to science course offerings, it was found that the Florida schools very slightly exceeded the offerings in science of the nation as a whole. That is, the percentage of the Florida schools offering any one of, or a combination of, general science, biology, chemistry, and physics was greater than the combined average of all of the other states.
2. The number of different science courses offered in the Florida schools was found to be related to school size. Almost without exception, the larger the enrollment of a school, the more extensive its science curriculum.

3. Access to science courses was denied to the greatest extent students enrolled in schools having less than 500 pupils.
4. The average science class in the schools surveyed was found to be composed of 27 students (the same as the national average); the larger schools were found to have the largest science classes.
5. Nearly two-thirds of the students enrolled in the high schools surveyed were taking one or more science courses. Biology, the most popular subject (required by the state), accounted for almost half of these. Eleven per cent of the students enrolled in the last four years of school were taking chemistry and 5 per cent, physics.
6. On the basis of science teacher judgments made at the time of the survey, the quality and the quantity of equipment and facilities for science instruction was rated in the following descending order: chemistry, general science, biology, and physics.
7. On the basis of an equipment index, items for the teaching of chemistry were found to be the most available; following, in

descending order, were biology, physics, and general science.

8. Of the 315 teachers instructing one or more sections of science (grades 9- 12), 8.6 per cent were not fully certified according to Florida certification requirements in effect as of June, 1959. These violations were greatest among the physics teachers, followed in descending order by the teachers of chemistry, biology, and general science. The part-time science teachers were found to be the most frequent violators of state certification requirements.

9. Although some of the high schools were moderately well equipped, most were so deficient in needed items as to seriously impair an effective science program. From an inventory of 380 basic items commonly used in teaching general science, biology, chemistry, and physics, it was found that most schools teaching these subjects had fewer than half.

10. According to recommendations outlined by the National Society for the Study of Education and the American Association for the

Advancement of Science, the average science teacher in the schools surveyed was found to have deficiencies in academic preparation, both in the subject taught and related subjects. Using 24 semester hours as recommended minimum preparation, the following deficiencies were exposed: the biology teachers had an average of 21 semester hours in biology; the chemistry teachers had an average of 19 hours in chemistry; and the physics teachers had an average of eight semester hours in physics.

11. Almost one-half of the science teachers in the 81 schools surveyed indicated that lack of equipment and supplies was their greatest source of difficulty in their science classes.

12. Nearly three-fourths of the science teachers in the 81 schools acknowledged a desire to take courses in science content in order to add to their competency as teachers.

Reactions of the survey team

At the outset of this study, the group selected to visit the schools voiced a desire to do more than

merely act as agents to gather data. They thought it important that some mention of their reactions be incorporated in this study and recommended that their perceptions be included because they thought that their reports would describe situations not necessarily treated in the instruments. Inasmuch as the individuals selected for the visitation committee were men who, to a great extent, shared a common background in science education, it was decided that their recommendation was well advised. Furthermore, it would be significant to note the extent of the agreement between the findings of the author, the reports of the teachers, and the reactions of the visitation staff--concensus would permit more confidence in the findings.

After completion of the survey, each member of the team was requested to submit a reaction report; they are included in Appendix VI. An analysis of these reactions revealed almost complete agreement between individuals with respect to equipment and facilities. The implication of their comments supports both the remarks of the teachers who returned a questionnaire and the findings of this survey. The reader is referred to these reactions to note the remarkable similarity of expression.

Recommendations

The findings of this survey indicate that there is a serious need for the high schools in Florida to expand their science curriculum. This is particularly true of the schools in which the enrollment is less than 200. The neglect of this factor in these schools is such that 80 per cent of the students are denied access to a four year science sequence.

The findings of this study also indicate that there is a necessity to expand many of the provisions presently made available for science instruction, and to construct them where they are non-existent. In some schools, the poverty of these things is so real that the only provisions for science are a teacher, a textbook, a classroom, and little else. The lack of suitable facilities and equipment is such a significant determent that frequently the values that may be derived from giving students an opportunity to gain first-hand experiences from lecture-demonstrations or laboratory classes are not achieved. It is recommended that each school have as minimum equipment those items which will permit a broad range of experiences in each of the sciences taught.

Science teachers need time and/or assistants to help prepare for class and maintain equipment. In many schools, it would found that science teachers were so

occupied, that they had little time to use what equipment they did possess; items which could have been used were often ignored. The load of a science teacher affects his attitudes and willingness to work with students--not only in the classroom but on projects, fair, and clubs, all of which are conducive to developing science talent.

Much of the equipment used in teaching the various high school science courses is expensive and many items, however desirable, have limited use. In schools with small enrollments, these considerations are probably the reasons for meager facilities and equipment. Two alternatives are suggested: consolidation and/or a central supply for science materials. The effective use of manpower and the school plant that results from consolidation is so well know that there is no need to elaborate any further. A science materials center is suggested as a source of borrowed equipment. A county system, for example, could organize a central agency, the responsibility of which would be to work with science teachers and loan them needed items of equipment. With planning and cooperation, the utilization of such a center could be both large scale and efficient.

It is recommended that every effort be made to extend to in-service science teachers opportunities to add to their academic background. In a study pertaining to

science achievement in biology and chemistry (5), it was disclosed that the achievement of students varied directly as the preparation of their teachers. It is recognized that achievement is not the sole desirable outcome of a science program—but it is important. Inasmuch as the science teachers in the schools surveyed were found to be deficient in their academic preparation, it is strongly urged that school officials encourage them to minimize this shortcoming. Many science teachers themselves acknowledged a desire to re-enforce their foundation in science content. Supervisory personnel should capitalize on this fact and make it possible for these teachers to do so by providing in-service science institutes or seminars.

Conclusion

In an unpublished doctor's dissertation concerned with the relationships between certain socio-economic factors, intelligence, and the academic achievement of Florida high school seniors (11), it was found that achievement in natural science was more a result of formal instruction in school than a matter of home and environmental associations and influences. If the schools act as a primary agency which generates student understandings in the natural sciences, it follows that they should be optimally endowed. This study has demonstrated that there

are certain important elements in the science programs in the Florida schools which are in need of improvement. Most of the factors chosen for investigation were found to be so limited as to seriously threaten the academic opportunity of many of Florida's high school students. If the enrollment in Florida's schools continues to change at the present rate, concerted effort must be made to mitigate the present critical situation in science education.

At the time that this study was initiated, school officials in Florida were beginning to take advantage of funds made available for up-grading science instruction under certain provisions of the National Defense Education Act. It will be interesting, some years hence, to observe what change this influence has encouraged. The author sincerely hopes that this study will provide a benchmark--a point of reference which, in the future, will be pointed to as an indicator to demonstrate how far we have come. Caution, however, should be observed for the elements investigated in this study may become obsolete.

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APPENDICES

APPENDIX I

UNIVERSITY OF FLORIDA
GAINESVILLE

College of Education February 19, 1959

This letter is to inquire if you would be willing to participate in a Five State-Wide Science Facilities Study planned and headed by Dr. Charles L. Koelsche, who is a specialist for science in the United States Office of Education, along with Dr. Obourn. Funds are available to reimburse you if you are interested and can find time to participate in this study.

It is proposed to make a careful inventory or survey of the equipment and facilities available in a twenty-five per cent random sample of the high schools of Florida and four other states. Dr. Koelsche has prepared the inventory which he is concerned to have carried out, but we at the University of Florida would like to get some additional information while visiting these schools. Mr. Shep Faber, a graduate student in science education who is preparing an inventory for this part of the study, plans to use his inventory and his participation in the study in connection with his doctoral dissertation. Among the other states participating in the study are South Carolina, Ohio and Wisconsin.

This seems a timely study for, as you know, funds are available from the National Defense Education Act for supplementing local resources in the purchase of needed facilities. In order to have some idea of what facilities are needed, it is necessary to have an idea of the facilities that are presently available. It is hoped, also, to get some evidence of the relationship of adequate facilities to adequate teaching.

Dr. Koelsche has worked out plans for the prosecution of the project somewhat as follows:

1. In each state there is to be a committee organized with a chairman from one of the universities and with sufficient field workers to collect the data. The number of schools to be visited will be approximately twenty schools by each person. In order to work out all details and obtain helpful suggestions from each state's personnel, Dr. Koelsche plans to meet with the various groups.

We are expecting him to meet with Mr. Faber and myself on Sunday, March 15, and then with the Florida committee on March 16.

2. It is proposed that the committee members try out their observations in the field and that they come back for a second meeting. We are suggesting March 28 as the date for this second meeting.

3. After studying the results and discussing the pilot study, then it seems that the field workers should be able to go out into the field and observe in the schools that have been assigned to them. It is planned to have different committee members work the section of the state near their home.

4. If you participate in this project (and if you cannot participate I hope you will suggest a name of someone who might help in this study) you would have the following demands on your time:

   a. A trip to Gainesville to be here Monday, March 16, and again to be here Saturday, March 28.

   b. The planned visits in certain selected schools during the interim period, and then the planned visits in perhaps fifteen to twenty schools during April.

   c. There will probably be a follow-up meeting in Gainesville after the visitations have been made.

5. For this you would receive travel and per diem expenses when on your trips to Gainesville, and the same is true when out observing the schools, plus ten dollars for each school visited.

These are the arrangements that I understand as conveyed to me over the phone by Dr. Koelsche. It appears to be an interesting project and a worthwhile one. I do hope that you can participate, but if you cannot, please suggest someone who may participate in your section of the state. May I hear from you right away so that we may get this project launched.

Cordially,

N. E. Bingham
Professor of Science Education

NEB:am

FACILITIES AND EQUIPMENT PRESENTLY AVAILABLE FOR TEACHING SCIENCE IN THE HIGH SCHOOLS

by

Charles L. Koelsche, Specialist for Secondary-School Science, U. S. Office of Education, Washington 25, D. C., and
Archie N. Solberg, Professor and Chairman, Department of Biology, University of Toledo, Toledo 6, Ohio

A cooperative research project sponsored jointly by the Cooperative Research Branch of the U. S. Office of Education and the University of Toledo - administered through the Research Foundation of the University of Toledo, Toledo 6, Ohio.

The following states are participating in this study: Florida, Illinois, Massachusetts, North Dakota, Ohio, South Carolina, and Wisconsin.

CHECK LIST. For use of state committee members visiting high schools.

Name of high school visited _____

Address _____
Street City State

Grades included in this school: (Place an "x" in the applicable space.)

_____ 7 through 12; _____ 9 through 12; _____to through 12.

Total enrollment by grade: _____9th grade; _____10th grade;

_____11th grade; _____12th grade.

Total enrollment in grades 9 through 12: _____; 10 through 12 _____.
(Senior H.S. only)

What science courses are being offered during 1958-59: If offered, give

	No. of Sections	Total enrollment
(If not offered, leave these spaces blank.)		
General Science	_____	_____
Biology	_____	_____
Chemistry	_____	_____
Physics	_____	_____

_____ _____ _____

Others - list

_____ _____ _____

_____ _____ _____

What science courses does this high school plan to offer next year - 1959-60?

List _____

Indicate the current status of facilities by placing an "x" in the space provided at the left of the most applicable item(s). If the facilities in this school consists of more than one room-laboratory and/or a room and separate laboratory, please complete separate extra sheet(s) in order to convey the true situation as you find it. This and three extra sheets, however, should be the maximum, irrespective of the number of rooms and laboratories, since an "average" picture for each of the following science areas is all that is desired: general science; biology; chemistry; and physics. Should you find advanced or special courses being offered, feel free to complete forms for them if they use other facilities than those already covered.

Science areas using the facilities check below are: _____

Number of rooms involved ____; Number of laboratories involved _____.

ROOM SPACE

..... 1. Separate recitation and laboratory rooms for each science area.

..... 2. Combination classroom and laboratory for each science area.

..... 3. Regular classroom - no special science room available.

..... 4. Same as (1) except multipurpose for two or more science areas.

..... 5. Same as (2) except multipurpose for two or more science areas.

..... 6. Same as (3) except a special movable lecture-demonstration table of adequate size and satisfactorily equipped is available.

..... 7. The location of the recitation and laboratory rooms is such that enlargement and modernization is possible.

..... 8. On an eight by eleven and one-half piece of graph paper ruled four squares to the inch, draw a rough sketch of a typical room and laboratory arrangement of facilities for teaching each science in this school. (No more than four such pictures for any one school.)

PRESENTATION FACILITIES

..... 1. Lecture-demonstration desk.

..... 2. Sink with running water on desk or in room.

..... 3. Gas outlet.

..... 4. A. C. electrical outlet.

..... 5. D. C. electrical outlet.

..... 6. Fume hood.

..... 7. Compressed air outlet.

..... 8. Lighting is adequate.

..... 9. Ventilation is adequate.

..... 10. Bulletin board.

..... 11. Room can be darkened for slides, film strips, and movie projection.

..... 12. Motion picture projection equipment is available.

..... 13. Slide projection equipment is available.

..... 14. Filmstrip projection equipment is available.

..... 15. Room has elevated seating or elevated lecture-demonstration desk.

..... 16. Give the approximate average square footage of usable chalkboard area in room(s) used for teaching science.

LABORATORY FACILITIES (Check these items even when the lecture and laboratory room are together.)

..... 1. Running water and sink or trough on each table or desk.

..... 2. Running water and sink in room but not on each table.

..... 3. Gas outlet on each table.

..... 4. Compressed are outlet available in room.

..... 5. A. C. electrical outlet in room.

..... 6. D. C. electrical outlet in room.

..... 7. Fume hood(s).

..... 8. Window or forced-air ventilation is adequate.

..... 9. Window and wall shelves.

..... 10. Open reagent and/or storage shelves.

..... 11. Closed storage cupboards.

..... 12. Separate storage and supply room.

..... 13. Equipment lockers are available in laboratory for student use.

..... 14. Give the approximate average square footage of usable chalkboard area in laboratories.

..... 15. Laboratory lighting is adequate.

MISCELLANEOUS FACILITIES

..... 1. Separate office space for the personal use of the instructor.

..... 2. Preparation room and/or teacher work room.

..... 3. Stock room adjoins or is easily accessible from the lecture-recitation or laboratory space.

..... 4. Are stock room storage shelves and/or cupboards adequate?

..... 5. Dark room for photography.

..... 6. Separate project room for student use.

..... 7. Periodical reference material is available in the classroom.

..... 8. Book reference material is available in the classroom.

..... 9. Exhibit cases.

..... 10. Plant growing room or greenhouse.

..... 11. Animal room or house.

..... 12. Safe audio-visual equipment storage space available.

..... 13. Periodicals and other current reference materials are available in the school library.

..... 14. Others. (Please specify.)_____

_____

GENERAL OBSERVATIONS ON FACILITIES

In consultation with the science teacher(s), select the item which best describes the situation in this school and place its number in the space at the left of each statement.

..... 1. Science facilities on the whole are
1. good
2. fair
3. poor.

..... 2. There is (1) too much, (2) adequate, (3) inadequate laboratory space per student in this school's facilities.

..... 3. The use of community resources in their natural setting - field trips - by this school is best described by which of the following?
1. Frequently used.
2. Moderately used.
3. Seldom used.
4. Not used.

..... 4. Laboratory and demonstration equipment is
1. well maintained.
2. indifferently maintained.
3. poorly maintained.

..... 5. Laboratory and demonstration equipment is
1. all out-dated.
2. all fairly new.
3. more out-dated than new.
4. more new than out-dated.

..... 6. This school (1) maintains, (2) does not maintain, a current running inventory of laboratory and demonstration equipment and supplies.

..... 7. The science teachers in this school have (1) no, (2) one, (3) two, (4) three, (5) four or more, hours per week of special time allocated for the preparation of laboratory work and demonstrations.

EQUIPMENT - GENERAL PROVISIONS

In consultation with the science teachers, select the item which best describes the situation in this school and place its number in the space at the left of each statement, or enter an "x" in the space provided at the left of the most applicable item(s).

..... 1. This school (1) has, (2) does not have, an annual budget for the purchase of permanent equipment.

..... 2. This school (1) has, (2) does not have, an annual budget for the purchase of consumable supplies.

..... 3. This school (1) charges, (2) does not charge, a laboratory fee.

..... 4. This school (1) collects, (2) does not collect, a breakage deposit which is refundable less any breakage costs.

..... 5. The science department in this school (1) can, (2) cannot, spend the laboratory and breakage fees collected without restrictions from the administration.

..... 6. Ifyour answer is (2) to the above item, these fees become
1. a part of the general fund.
2. a special fund for purchase of future equipment and/or supplies.
3. others. (Please specify.)_____

_____

Special sources of funds:

..... 7. Parent-teachers association.

..... 8. Local service clubs, such as Kiwanis.

..... 9. A school benefit program or party.

..... 10. Admission receipts from exhibits or science fairs.

..... 11. Interested parent or citizen.

..... 12. A local scientifical society.

..... 13. A local industry.

..... 14. Others. (Please specify.) _____

General plan used for purchasing equipment:

..... 1. Each science teacher orders directly from supply houses.

..... 2. Head of the science department orders for all of his teachers from supply houses.

..... 3. Principal orders for all the teachers from supply houses.

..... 4. Superintendent orders for all the teachers from supply houses.

..... 5. All orders are pooled and bids are obtained from several suppliers; the lowest bidder filling the order.

..... 6. All orders are processed through a central purchasing agency; then purchased from supply houses.

..... 7. Contract made with one supplier who furnishes equipment and supplies as ordered.

..... 8. Others. (Please specify.) _____

Sources of borrowed and/or donated equipment:

..... 1. Institutions of higher learning.

..... 2. Hospitals.

..... 3. Doctor's offices.

..... 4. Professional societies, such as American Chemical Society.

..... 5. Industry.

..... 6. Garages.

..... 7. Filling stations.

..... 8. Stores.

..... 9. Government surplus property programs.

.....10. Others. (Please specify.)_____

_____

Miscellaneous:

_____ 1. Did this school or school system have a 1958-59 budget item for the purchase of science equipment? If so, give the approximate amount in the space at the left.

..... 2. This amount represented a (an) (1) increase, (2) decrease, (3) no change, from the 1957-58 allotment.

_____ 3. Did this school or school system have a 1958-59 budget item for the purchase of consumable science supplies? If so, give the approximate amount in the space at the left.

..... 4. This amount represented a (an) (1) increase, (2) decrease, (3) no change from the 1957-58 allotment.

(If more than one high school was involved in these appropriations, give the number of schools involved here _____.)

..... 5. To what extent is improvised equipment utilized? (Include things which the students bring in and make.)

1. Not all.
2. Seldom.
3. Moderately.
4. Frequently.

This form was completed by _____,
state committee member in cooperation with _____
_____, principal ( ) or teacher ( ), this _____
day of _____, 1959.

Please note: Use the back of this page to give any information which you feel would add significantly to our background on the present status of this schools facilities for teaching the science courses offered. Such comments will be appreciated.

FLORIDA SCHOOLS SECONDARY SCIENCE STATUS STUDY 1959

1. Name of High School _____

2. Address _____

3. Number of full time science teachers _____

4. Number of part time science teachers _____

5. The time allowed for one class period is ___minutes.

6. (Check where appropriate.)

_____ Laboratory experiences are not available.

_____ Laboratory experience are made available as part of the regular class meeting.

_____ Laboratory experiences are made available during regularly scheduled sessions in addition to the normal daily sessions.

7. If laboratory periods are scheduled please complete the chart below:

Labs scheduled	No. of weekly meetings	Total lab time per wk.
General Science		
Biology		
Chemistry		
Physics		
Others		

8. If the librarian has a shelf list, how many volumes are there between 500 and 699.99? _____

If this list does not include the science periodicals, how many are there? _____

Check the periodicals listed below to which the school library subscribes.

_____ Science News Letter
_____ National Geographic
_____ Scientific American
_____ Science Digest
_____ Popular Science
_____ Popular Mechanix
_____ Natural History
_____ Nature
_____ Others: _____

9. What provisions, if any, are made for students with special abilities?

_____

10. Do the science teachers have student assistants or others to help with demonstrations, the keeping of stock rooms, etc? Yes ___ No ___

11. Did or will the school have a Science Fair this year? Yes ___ No ___

12. Did or will the school participate in a regional Science Fair this year? Yes ___ No ___

13. What if any unusual circumstances surround the science programs which are worthy of note? _____

_____

14. What, if any, science awards did members of the last graduating class receive? _____

15. In what year were the science facilities now being used constructed? _____

16. PLEASE SECURE A CLASS SCHEDULE SHOWING NAMES OF TEACHERS AND CLASS ASSIGNMENTS.

Thank you.

EQUIPMENT AVAILABLE FOR TEACHER AND STUDENT USE

Check list. For use of visiting state committee member in cooperation with the local science teacher and/or principal.

Name of high school _____

Address _____
Street City State

The following lists give the names of some of the essential items - equipment as opposed to expendible supplies - needed in teaching the various high school science courses.

In completing the blanks at the left of each piece of equipment, please give the approximate number of pieces available for use. If not available, please a zero in the spece. This procedure will indicate the approximate inventory now on hand. The record will be of inestimate value to each school in applying for federal funds under the provisions of the National Defense Education Act of 1958.

This check form may be completed by the school's secretary if a 1958-59 inventory is available. Otherwise it should be jointly completed at the time of visitation.

GENERAL SCIENCE

..... 1. altimeter, 500-5000 ft., dial face

..... 2. anemometer, weather instrument type

..... 3. Aquarium, 3 gallon or larger

..... 4. binoculars

..... 5. chart, acoustic

..... 6. chart, astronomy

..... 7. chart, atomic structure

..... 8. chrrt, atomic weight

..... 9. chart, barometric

.....10. chart, electrochemical

.....11. chart, electromagnetic radiation
.....12. chart, periodic
.....13. chart, vision
.....14. chime, electric, two bell
.....15. constant level tubes, communicating vessels
.....16. dew point apparatus, Millikan's
.....17. globe, celestial
.....18. globe, Hall Tellurian, longitude and latitude
.....19. globe, terrestial
.....20. gyroscope, bicycle wheel with handles
.....21. hygrometer, aneroid, 0 - 100 per cent
.....22. hygrometer, sling psychometer
.....23. hygrometer, wet and dry bulb, with chart
.....24. map, geological
.....25. map, hemispherical
.....26. model, airplane
.....27. model, engines, diesel, gas, steam, turbine
.....28. planetarium, Spitz with canopy
.....29. planetarium, mechanical model of inner solar system
.....30. rain gauge
.....31. telescope, refracting, two, three, or four inch
.....32. telescope, refracting, two, three, or four inch

Please list any pertinent additional equipment not previously covered.

_____
_____
_____
_____
_____
_____

BIOLOGY EQUIPMENT

Student personal locker equipment

..... 1. bladder

dissection sets containing

..... 2. scapel ..... 4. needles

..... 3. forceps ..... 5. scissors

..... 6. dissection pans - waxed lined

..... 7. magnifiers, adjustable tripod type

..... 8. medicine dropper

..... 9. mounts, specimen, 5" x 6"

General equipment

..... 1. animal collection, classified

..... 2. acquarium with livestock

..... 3. acuarium heater with thermostate

..... 4. balance, platform or beam type

..... 5. bell jars, assorted

..... 6. binoculars

..... 7. burner, bunsen or equivalent type

..... 8. cages, animal

..... 9. cages, insect

.....10. centrifuge, electricaly driven

.....11. charts, biological, assorted

.....12. cooker, pressure

.....13. cylinders, graduated

.....14. gauze, wire

.....15. hot plate, electric

.....16. human torso

.....17. incubator, electric

.....18. kymograph and accessories

.....19. lung, artificial

.....20. microscope, 3 objective oil-immersion lens for instructor's use

.....21. microscopes, 2 objective oil-immersion lens for instructor's use

models of

.....22. kidney

.....23. ear

.....24. eye

.....25. heart

.....26. brain

.....27. assortment of plants and plant parts.

.....28. petri dishes, culture

.....29. polarizer

.....30. slides, blank with cover slips - some concave for mobility

.....31. slides, microscope, assortment of prepared ones

.....32. terrarium

.....33. test tube holder

.....34. tubing, glass

.....35. tubing, rubber

.....36. spirometer

.....37. soil testing kit

.....38. ring stand, assortment of rings, and burette clamp

.....39. preserved specimens, assorted

.....40. osmometer

.....41. glassware, assortment of beakers, flaks, and test tubes

Please list any pertinent additioanl equipment not previously covered.

CHEMISTRY EQUIPMENT

Student personal locker equipment

..... 1. beakers, assortment
..... 2. blowpipe, 8"
..... 3. bottles, wide-mouth
..... 4. brush, test tube
..... 5. burner, bunsen or equivalent and tubing
..... 6. crucible and cover
..... 7. dish, evaporating
..... 8. file, triangular
..... 9. flask, florence
.....10. flask, erlenmeyer
.....11. forceps
.....12. funnel
.....13. gauze, wire
.....14. glass plates, and one cobalt plate
.....15. graduated cylinder
.....16. mortar and pestle
.....17. pinchcock - compressor type
.....18. rack - test tube
.....19. rubber stoppers, assorted
.....20. spatula
.....21. spoon, deflagrating
.....22. test tubes, assorted
.....23. test tube holder
.....24. thermometers, C and F

.....25. thistle tube

.....26. tubing, glass

.....27. tubing, rubber, 3/16"

.....28. tongs, crucible

.....29. trough, pneumatic

.....30. triangle, pipe-stem

.....31. watch glasses

.....32. wing top for burner

General laboratory equipment

..... 1. blanace, analytical

..... 2. balance, triple beam or platform

..... 3. barometer, mercury or aneroid

..... 4. bottles, reagent for laboratory desks

..... 5. bottles, reagent for side shelves

..... 6. burettes, 50 ml

..... 7. cabinet, first aid

..... 8. clamps, burette

..... 9. condensers and clamps

.....10. chart, periodic table

.....11. chart, electrochemical series

.....12. conductivity apparatus

.....13. cork borer set

.....14. cork assortment

.....15. cylinder, graduated, 100 to 1000 ml

.....16. beakers, 600 to 1000 ml

.....17. desiccator with plate

.....18. electrolysis apparatus

.....19. funnels, Buechner's

.....20. generator, gas, Kipp

.....21. hot plate, electric

.....22. hydrometer, universal

.....23. kit, atomic model

.....24. lamp, blast

.....25. model, molecular

.....26. magnifiers, tripod or equivalent

.....27. oven, drying

.....28. ozone, generating apparatus

.....29. pipettes, assortment

.....30. retorts with glass stoppers

.....31. ring stands, assortment of rings and burette clamps

.....32. soil testing set

.....33. spot plates

.....34. still, water

.....35. thermometer, assortment

.....36. weights, 10 g to 1000 g

.....37. weights, analytical 50 mg to 100 g

.....38. wire, platinum

Does this school use semi-micro laboratory technique in chemistry?

.....39. Yes .....40. No

If so, in the space below, list the specific apparatus available for use in this technique, such as centrifuges, reagent trays, etc.

_____

PHYSICS EQUIPMENT

..... 1. air jet attachment, for tones

..... 2. ammeter, a.c., 1 amp

..... 3. ammeter, a.c., 10 amp

..... 4. amplifier, audio-frequency

..... 5. Archimedes' Principle apparatus

..... 6. balances, platform

..... 7. balances, triple-beam

..... 8. balance, dial spring - 500 g

..... 9. balance, spring 250 g

.....10. balls, aluminim 1"

.....11. ball, inertia

.....12. balls, lead 1"

.....13. balls, wood

.....14. balls, bouncing and non-bouncing

.....15. ball and ring, expansion

.....16. barometer, aneroid

.....17. barometer, mercurial

.....18. barometer, recording, barograph

.....19. battery jar - one gallon

.....20. batter, storage

.....21. battery substitute rectifier, 115 volt a.c. for low voltage a.c. and d.c.

.....22. bell in vacuo, for sound experiment

.....23. bell jars, assortment

.....24. bench, optical

.....25. boiler, cryophorous

.....26. box, resistance - 3 dial

.....27. Boyle's law apparatus - J form

.....28. Brownian movement apparatus

.....29. burner, Bunsen type

.....30. burner, Fisher high temp

.....31. caliper, micrometer

.....32. caliper, Vernier

.....33. calorimeter

.....34. camera, 35 mm Kodak or equivalent

.....35. can, overflow

.....36. capillary set

.....37. Cartesian diver set

.....38. centrifugal hoop

.....39. chart, spectrum

.....40. clamps, condenser

.....41. cell, student

.....42. centrifuge, hand type

.....43. clamps, knife-edge

.....44. clamps, pendulum

.....45. clamps, right angle

.....46. clamp, meter stick

.....47. clamp, swivel

.....48. clamp, table

.....49. clamps, tubing

.....50. coils, resistance - set of 8

.....51. clamps, lens

.....52. cohesion figures

.....53. coils, induction

.....54. coils, primary and secondary

.....55. compass, declination

.....56. compass, inclination

.....57. compass, magnetic-jeweled

.....58. compass, magnetic - small

.....59. conductometer

.....60. convection box

.....61. cord, extension - 5 ft.

.....62. cord, linen for pulleys

.....63. double cone and plane

.....64. drawing compasses

.....65. dynamo, hand powered, demonstration

.....66. dynamo, hand powered, demonstration

.....67. electromagnet

.....68. electromagnet attachment

.....69. electrophorus

.....70. electroscope, metallic-leaf

.....71. electroscope, pith-ball

.....72. electrostatic demonstration set

.....73. engine, working model, gas, steam, steam turbine

.....74. files, 1 triangular, 1 flat

.....75. filmloops, radioactive

.....76. filings, iron

.....77. force board

.....78. fur-half cat skin

.....79. fluoroscope, demonstration type

.....80. gear train

.....81. galvanometer, lecture table

.....82. geiger counter, complete

.....83. Geissler tubes set

.....84. generator, steam

.....85. generator, magneto-electric hand operated, with light

.....86. glassware, assorted - beakers, flasks, funnels

.....87. glass, pulse

.....88. German silver wire No. 22

.....89. gyroscope

.....90. Halls, carriage

.....91. hangers, weight

.....92. Hooke's law apparatus

.....93. Hooke's law spring

.....94. hydrometer for heavy liquids

.....95. hydrometer jar 18 x 3

.....96. hydrometer, battery

.....97. hygrometer

.....98. inclined plane

.....99. jar, bell

....100. knife

....101. lamp, ultraviolet

....102. lamps with screw base

.....103. lamp, carbon arc

.....104. lamp socket assembly for series and parallel circuits

.....105. lens, assortment

.....106. lenses, spherical

.....107. lead sinkers

.....108. leyden jars

.....109. linear expansion apparatus (lever or micrometer form)

.....110. liter case

.....111. liquid set, fluorescent

.....112. lever demonstration apparatus-knife edge, fulcrum, support

.....113. lodestone

.....114. Magdeburg hemispheres

.....115. magnet, Alnico

.....116. magnet, U

.....117. magnets, bar

.....118. magnets, assorted

.....119. metal, assorted strips

.....120. meter sticks

.....121. meter stick - four scale

.....122. meter, foot candle

.....123. metronome

.....124. mirror, spherical

.....125. motor, St. Louis

.....126. model vernier

.....127. model gasoline (engine) cross section for demonstrating the four-cycle principle

.....128. model diesel (engine) cross section for demonstrating working principle

.....129. microphones, crystal and carbon

.....130. needle, magnetic

.....131. Oerstad's law apparatus - simple form

.....132. object holders for meter sticks

.....133. optical disk with accessories

.....134. organ pipe with sliding piston

.....135. osmosis apparatus

.....136. Pascal's vases - simple form

.....137. pendulum

.....138. prism, equilateral

.....139. proof plane

.....140. protractors

.....141. photoelectric cell and relay

.....142. photometer, bunsen

.....143. physics charts

.....144. plate, index of refraction

.....145. Polaroid kit

.....146. power unit, electric 110 a.c. imput, variable output a.c. and d.c.

.....147. pulleys, assorted

.....148. pump, air

.....149. pump, force model

.....150. pump, lift model

.....151. uump, vacuum - electric

.....152. Oscilloscope, cathrode ray

.....153. radiometer

.....154. radio receiver - demonstration panel

.....155. rectifier, tungar

.....156. reflectors, parabolic

.....157. rods, 40 cm long

.....158. rod, 100 cm

.....159. rods, assortment

.....160. rotator, electric

.....161. resistance boxes, variable

.....162. scale pans

.....163. sheath, rubber

.....164. singing flame apparatus

.....165. soldering gun or electric soldering iron

.....166. sonometer - simple form

.....167. silk

.....168. speaker, permanent magnet

.....169. specimens, specific heat

.....170. specimens, specific gravity

.....171. specific gravity bottle

.....172. spectroscope, direct vision

.....173. static machine - Van De Graff

.....174. static machine - Wimhurst

.....175. storage cell apparatus

.....176. stethoscope

.....177. stirrups for bar magnet

.....178. support, magnet
.....179. switch, knife - one pole
.....180. switch, knife - two pole
.....181. string vibrator
.....182. stroboscope, neon
.....183. syringe, pressure
.....184. taps, cell
.....185. tank, refraction
.....186. telegraph set - complete
.....187. telephone station
.....188. television receiver
.....189. kthermocouple
.....190. thermometers, C and F
.....191. timer; intervals
.....192. timer, stop watch
.....193. time controls, electric
.....194. tripods
.....195. tripod base
.....196. trough, pneumatics
.....197. transformer, demonstration
.....198. tube, calibrated liquid pressures
.....199. tubes, Crookes, for deflection of cathode rays
.....200. tube, X-ray
.....201. tube, guinea-and-feather
.....202. tube, barometer
.....203. tube, resonance

.....204. tubing, glass

.....205. tubing, rubber

.....206. tuning forks, assortment

.....207. tuning forks - sympathetic pair

.....208. Universal light source

.....209. voltmeter, a.c., 150/15/3

.....210. voltmeter, d.c., 15/1.5

.....211. weights, sets hooked

.....212. weights, slotted - metric

.....213. weights, general laboratory

.....214. weights, 1 g - 500 g

.....215. wire, bell No. 20

.....216. wire, steel, assorted sizes

.....217. worm and gear set

.....218. Wheatstone bridge - slide wire

.....219. wheel and axle

.....220. vibrograph

Please list any pertinent additional equipment not previously covered.

_____

_____

_____

Please list any special electronic and radiation equipment noted.

_____

_____

_____

_____

_____

In consultation with the science teacher(s), select the items which best describes the situation in this school and place its number in the space at the left of each statement.

..... 1. Science equipment for teaching biology is on the whole
1. good
2. fair
3. poor

..... 2. Expendible supplies for teaching biology are on the whole
1. good
2. fair
3. poor

..... 3. Science equipment for teaching chemistry is on the whole
1. good
2. fair
3. poor

..... 4. Expendible supplies for teaching chemistry are on the whole
1. good
2. fair
3. poor

..... 5. Science equipment for teaching physics is on the whole
1. good
2. fair
3. poor

..... 6. Science equipment and supplies available for teaching general science are on the whole
1. good
2. fair
3. poor

This form was completed by _____ on the _____ day of _____, 1959. My title is _____ _____.

TABLE 49-W

THE NUMBER (N) OF WHITE HIGH SCHOOLS REPORTING THE LISTED ITEMS OF GENERAL SCIENCE EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

	Item	Size of School									
		(21)* 1-199		(11)* 200-499		(8)* 500-999		(1)* 1000-up		(41)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
1.	Altimeter, dial face	0	0	0	0	1	1	0	0	1	1
2.	Anemometer, weather	0	0	1	1	2	2	0	0	3	3
3.	Aquarium	13	18	9	13	3	4	0	0	25	35
4.	Binoculars	1	1	1	1	0	0	0	0	2	2
	Charts:										
5.	Acoustic	1	1	1	1	0	0	0	0	2	2
6.	Astronomy	2	2	2	2	1	1	1	1	6	6
7.	Atomic structure	5	6	3	3	1	1	1	1	10	11
8.	Atomic weight	9	9	7	7	2	2	0	0	18	18
9.	Barometric	2	2	2	2	0	0	0	0	4	4
10.	Electrochemical	1	2	2	2	1	1	0	0	4	5
11.	Radiation, electro-magnetic	0	0	1	1	1	1	0	0	2	2
12.	Periodic	11	11	9	9	4	4	0	0	24	24
13.	Vision	7	7	4	5	2	2	1	1	14	15
14.	Chime, electric	1	1	1	1	2	4	0	0	4	6
15.	Constant level tubes	3	3	4	4	3	3	0	0	10	10

TABLE 49-W continued

Item	Size of School									
	(21)* 1-199		(11)* 200-499		(8)* 500-999		(1)* 1000-up		(41)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
16. Dew point apparatus, Millikan's	3	4	3	4	1	2	0	0	7	10
17. Globe, celestial	2	2	1	1	0	0	0	0	3	3
18. Globe, Hall Tellurian, longitude and latitude	3	3	2	2	2	2	0	0	7	7
19. Globe, terrestial	4	4	4	5	4	4	1	2	13	15
20. Gyroscope, bicycle wheel and handles	2	2	1	1	1	1	0	0	4	4
21. Hygrometer, aneroid	1	1	2	2	0	0	0	0	3	3
22. Hygrometer, sling psychrometer	0	0	3	3	2	2	0	0	5	5
23. Hygrometer, wet and dry	4	4	2	7	2	2	1	1	9	14
24. Map, geological	0	0	0	0	0	0	1	1	1	1
25. Map, hemisperical	0	0	1	1	1	1	0	0	2	2
26. Model, airplane	0	0	0	0	1	2	0	0	1	2
27. Models, engines, assortment	8	8	6	8	3	6	1	1	18	23
28. Planetarium, Spitz with canopy	0	0	0	0	0	0	0	0	0	0
29. Planetarium, mechanical solar system	4	4	0	0	0	0	0	0	4	4
30. Rain gauge	2	2	2	11	1	4	0	0	5	17

TABLE 49-W continued

Item	Size of School (21)* 1-199 N	Q	(11)* 200-499 N	Q	(8)* 500-999 N	Q	(1)* 1000-up N	Q	(41)* Totals N	Q
31. Still, water	3	3	0	0	3	3	0	0	6	6
32. Telescope, refract.	0	0	0	0	0	0	0	0	0	0
33. Telescope, reflect.	0	0	1	1	0	0	0	0	1	1
Equipment Index	13.3		20.9		16.7		21.2		16.0	

*The number of schools in the category in which general science was taught.

TABLE 50-N

THE NUMBER (N) OF NEGRO HIGH SCHOOLS REPORTING THE LISTED ITEMS OF GENERAL SCIENCE EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

Item	Size of School (11)* 1-199 N	Q	(6)* 200-499 N	Q	(3)* 500-999 N	Q	(0)* 1000-up N	Q	(20)* Totals N	Q
1. Altimeter, dial face	0	0	0	0	0	0	0	0	0	0
2. Anemometer, weather	1	1	1	1	1	1	0	0	3	3
3. Aquarium	4	4	3	5	3	6	0	0	10	15
4. Binoculars	1	2	1	1	1	1	0	0	3	4

TABLE 50-N continued

Item	Size of School									
	(11)* 1-199		(6)* 200-499		(3)* 500-999		(0)* 1000-up		(20)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
Charts:										
5. Acoustis	0	0	1	1	0	0	0	0	1	1
6. Astronomy	1	1	1	1	0	0	0	0	2	2
7. Atomic structure	1	1	2	2	0	0	0	0	3	3
8. Atomic weight	3	3	4	4	0	0	0	0	7	7
9. Barometric	1	1	0	0	0	0	0	0	1	1
10. Electrochemical	0	0	0	0	0	0	0	0	0	0
11. Radiation, electro-magnetic	1	1	0	0	0	0	0	0	1	1
12. Periodic	3	3	4	4	2	2	0	0	9	9
13. Vision	2	3	1	2	1	1	0	0	4	6
14. Chime, electric	0	0	0	0	1	1	0	0	1	1
15. Constant level tubes	0	0	2	3	0	0	0	0	2	3
16. Dew point apparatus, Millikan's	0	0	0	0	0	0	0	0	0	0
17. Globe, celestial	1	2	0	0	0	0	0	0	1	2
18. Globe, Hall Tellurian, longitude and latitude	1	1	0	0	0	0	0	0	1	1
19. Globe, terrestial	0	0	0	0	2	1	0	0	2	1
20. Gyroscope, bicycle wheel and handles	1	1	0	0	0	0	0	0	1	1

TABLE 50-N continued

	Item	Size of School (11)* 1-199 N	Q	(6)* 200-499 N	Q	(3)* 500-999 N	Q	(0)* 1000-up N	Q	(20)* Totals N	Q
21.	Hygrometer, aneroid	0	0	3	3	0	0	0	0	3	3
22.	Hygrometer, sling psychrometer	0	0	0	0	0	0	0	0	0	0
23.	Hygrometer, wet and dry	1	1	3	3	0	0	0	0	4	4
24.	Map, geological	1	1	0	0	0	0	0	0	1	1
25.	Map, hemisperical	1	1	1	2	0	0	0	0	2	3
26.	Model, airplane	1	1	0	0	1	8	0	0	2	9
27.	Models, engines, assortment	1	1	2	2	1	2	0	0	4	5
28.	Planetarium, Spitz with canopy	0	0	0	0	0	0	0	0	0	0
29.	Planetarium, mechanical solar system	1	1	0	0	1	1	0	0	2	2
30.	Rain gauge	0	0	1	2	0	0	0	0	1	2
31.	Still, water	0	0	0	0	1	1	0	0	1	1
32.	Telescope, refract.	0	0	0	0	0	0	0	0	0	0
33.	Telescope, reflect.	0	0	0	0	0	0	0	0	0	0
	Equipment Index	7.4		15.1		15.1		—		10.9	

*The number of schools in the category in which general science was taught.

TABLE 51-W

THE NUMBER (N) OF WHITE HIGH SCHOOLS REPORTING THE LISTED ITEMS OF BIOLOGY EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

Item	Size of School									
	(29)* 1-199		(11)* 200-499		(10)* 500-999		(5)* 1000-up		(55)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
1. Animal collections	11	11	3	3	5	5	4	4	23	23
2. Aquarium with livestock	10	14	3	6	7	17	5	15	25	52
3. Aquarium heater with thermostat	5	5	0	0	3	3	3	9	11	17
4. Balance, platform or beam type	18	30	7	26	3	17	1	1	29	74
5. Bell jars, assorted	9	10	9	22	3	4	2	6	23	42
6. Binoculars	3	6	0	0	0	0	1	1	4	7
7. Bladder	4	30	0	0	1	1	0	0	5	31
8. Burner, Bunsen type or equivalent	20	165	10	154	7	63	5	19	42	401
9. Cages, animal	5	6	5	21	6	15	4	23	20	65
10. Cages, insect	4	4	1	1	3	6	4	8	12	19
11. Centrifuge, electric	3	4	0	0	0	0	0	0	3	4
12. Charts, biological, asstd	13	30	11	48	9	20	5	35	38	133
13. Cooker, pressure	2	5	1	1	0	0	0	0	3	6
14. Cylinders, graduated	15	123	8	94	2	31	3	8	28	156

TABLE 51-W continued

	Item	Size of School									
		(29)* 1-199		(11)* 200-499		(10)* 500-999		(5)* 1000-up		(55)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
	Dissection sets:										
15.	Scapel	14	86	6	63	4	75	1	35	25	259
16.	Forceps	13	112	6	63	5	80	1	35	25	290
17.	Needles	13	189	7	67	5	81	1	35	26	372
18.	Scissors	12	81	7	68	5	78	1	35	25	262
19.	Dissection pans--wax lined	6	40	10	109	6	116	1	35	23	300
20.	Gauze, wire	14	144	8	123	3	42	2	10	27	319
21.	Hot plate, electric	6	6	3	3	3	5	1	1	13	15
22.	Human torso	5	5	1	1	5	5	5	5	16	16
23.	Incubator, electric	3	3	2	2	0	0	1	1	6	6
24.	Kymograph and acces.	0	0	0	0	0	0	0	0	0	0
25.	Lung, artificial	2	3	1	1	2	2	3	3	8	9
26.	Magnifiers, tripod	16	93	9	47	5	52	1	24	31	216
27.	Medicine dropper	13	115	9	163	5	102	1	36	28	416
28.	Microscope, 3 objective, oil-immersion lens for instructor's use	4	4	2	2	1	2	2	3	9	11
29.	Microscopes, 2 objective two-high-dry for student use	21	60	10	31	9	47	5	63	45	201

TABLE 51-W continued

	Item	Size of School									
		(29)* 1-199		(11)* 200-499		(10)* 500-999		(5)* 1000-up		(55)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
	Models:										
30.	Kidney	0	0	0	0	0	0	1	1	1	1
31.	Ear	4	4	2	2	3	3	4	4	13	13
32.	Eye	3	3	3	3	4	4	5	5	15	15
33.	Heart	1	1	2	2	3	3	5	5	11	11
34.	Brain	1	1	0	0	3	3	5	5	9	9
35.	Assortment of plants and their parts	1	1	1	1	2	2	1	1	5	5
36.	Mounts, specimen	2	14	2	30	3	46	0	0	7	90
37.	Petri dishes, culture	18	316	11	170	7	65	5	46	41	597
38.	Polarizer	0	0	2	2	0	0	0	0	2	2
39.	Slides, blank with cover slips--some concave	15	1,086	7	474	9	173	4	68	35	1,801
40.	Slides, microscope, assortment of prepared ones	21	331	10	543	8	614	5	200	44	1,688
41.	Terrarium	3	3	4	4	8	8	3	3	18	18
42.	Test tube holder	17	IND	9	IND	4	IND	3	IND	33	IND
43.	Tubing, glass (lbs.)	19	IND	9	IND	2	IND	2	IND	32	IND
44.	Tubing, rubber (ft.)	20	IND	9	IND	3	IND	1	IND	33	IND

TABLE 51-W continued

Item	Size of School (29)* 1-199 N	Q	(11)* 200-499 N	Q	(10)* 500-999 N	Q	(5)* 1000-up N	Q	(55)* Totals N	Q
45. Spirometer	1	3	0	0	0	0	1	1	2	4
46. Soil testing kit	3	3	1	1	0	0	0	0	4	4
47. Ring stand, assortment of rings, and burette clamp	15	IND	9	IND	4	IND	3	IND	31	IND
48. Preserved specimens, assorted	16	426	7	169	8	115	4	300	35	1,010
49. Osmometer	0	0	1	1	1	1	2	2	4	4
50. Glassware, assortment of	17	IND	9	IND	4	IND	3	IND	33	IND
Equipment Index	30.4		43.1		36.6		48.0		35.7	

*The number of schools in the category in which biology was taught.

IND - Indeterminate

TABLE 52-N

THE NUMBER (N) OF NEGRO HIGH SCHOOLS REPORTING THE LISTED ITEMS OF BIOLOGY EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

	Item	Size of School									
		(12)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(24)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
1.	Animal collection	5	5	1	1	3	3	1	1	10	10
2.	Aquarium with livestock	6	8	2	2	3	3	1	3	12	16
3.	Aquarium heater with thermostat	2	2	0	0	0	0	1	1	3	3
4.	Balance, platform or beam type	7	9	2	4	4	9	1	4	14	26
5.	Bell jars, assorted	4	18	2	7	3	4	1	2	10	31
6.	Binoculars	0	0	0	0	1	1	0	0	1	1
7.	Bladder	9	86	6	102	3	47	1	10	19	245
8.	Burner, Bunson type or equivalent	3	3	1	1	2	5	1	2	7	11
9.	Cages, animal	2	3	1	1	1	1	0	0	4	5
10.	Cages, insect	0	0	0	0	1	1	0	0	1	1
11.	Centrifuge, electric	8	12	5	15	4	12	1	6	18	45
12.	Charts, biological, asstd	0	0	0	0	2	2	0	0	2	2
13.	Cooker, pressure	6	33	6	73	3	33	1	3	16	142
14.	Cylinders, graduated	7	54	6	116	3	19	1	6	16	195

TABLE 52-N continued

Item	Size of School									
	(12)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(24)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
Dissection sets:										
15. Scapel	9	61	4	32	3	52	1	6	17	151
16. Forceps	9	74	4	45	3	52	1	6	17	177
17. Needles	8	71	4	41	3	52	1	6	16	170
18. Scissors	9	75	4	50	3	52	1	6	17	183
19. Dissection pans--wax lined	7	93	4	43	3	34	1	18	15	188
20. Gauze, wire	7	54	6	116	3	19	1	6	17	195
21. Hot plate, electric	2	2	0	0	0	0	1	1	3	3
22. Human torso	2	2	2	2	2	2	0	0	6	6
23. Incubator, electric	0	0	0	0	3	3	0	0	3	3
24. Kymograph and acces.	0	0	0	0	0	0	0	0	0	0
25. Lung, artificial	0	0	0	0	1	1	0	0	1	1
26. Magnifiers,tripod	5	35	2	22	3	13	1	6	10	76
27. Medicine dropper	8	95	4	54	3	50	1	6	16	205
28. Microscope, 3 objective, oil-immersion lens for instructor's use	1	2	2	3	1	2	0	0	4	7
29. Microscopes, 2 objective two-high-dry for student use	9	17	5	9	4	38	1	3	19	67

TABLE 52-N continued

Item	Size of School									
	(12)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(24)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
Models:										
30. Kidney	0	0	0	0	0	0	0	0	0	0
31. Ear	0	0	3	3	2	2	0	0	5	5
32. Eye	0	0	3	3	3	4	0	0	6	7
33. Heart	1	1	3	3	2	2	0	0	6	6
34. Brain	3	17	0	0	1	1	0	0	4	18
35. Assortment of plants and their parts	3	17	0	0	1	1	0	0	4	18
36. Mounts, specimen	1	3	0	0	1	6	0	0	2	9
37. Petri dishes, culture	7	49	4	37	3	26	1	1	15	113
38. Polarizer	1	4	0	0	0	0	0	0	1	4
39. Slides, blank with cover slips--some concave	4	399	5	121	4	400	0	0	13	920
40. Slides, microscope, asstd	10	10	6	6	2	2	1	1	19	19
41. Terrarium	2	2	3	3	1	1	1	1	7	7
42. Test tube holder	7	50	6	85	2	42	1	8	16	185
43. Tubing, glass (lbs.)	6	27	6	73	3	16	1	*	15	116
44. Tubing, rubber (ft.)	6	194	5	230	3	46	1	*	14	470

TABLE 52-N continued

Item	Size of School									
	(12)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(24)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
45. Spirometer	0	0	0	0	0	0	0	0	0	0
46. Soil testing kit	1	1	1	1	2	3	1	1	5	6
47. Ring stand, assortment of rings, and burette clamp	7	59	5	80	3	25	1	6	16	172
48. Preserved specimens, asstd	7	205	7	192	3	9	0	0	17	406
49. Osmometer	1	1	1	1	0	0	0	0	2	2
50. Glassware, assorted beakers, flasks, and test tubes	7	IND	3	IND	4	IND	1	IND	13	IND
Equipment index	34.7		38.9		53.5		58.0		40.0	

*The number of schools in the category in which biology was taught.

IND - Indeterminate

TABLE 53-W

THE NUMBER (N) OF WHITE HIGH SCHOOLS REPORTING THE LISTED ITEMS OF CHEMISTRY EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

Item	Size of School									
	(14)* 1-199		(10)* 200-499		(10)* 500-999		(5)* 1000-up		(39)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
1. Balance, analytical	1	3	4	5	4	10	4	35	13	53
2. Balance, triple-beam or platform	11	38	10	22	9	24	5	39	35	123
3. Barometer, mercury or aneroid	7	12	7	8	6	8	4	4	24	32
4. Beakers, assortment	9	IND	7	IND	8	IND	5	IND	29	IND
5. Blowpipe, 8 inch	7	50	7	63	7	63	5	157	26	433
6. Bottles, reagent for laboratory desks	9	IND	7	IND	8	IND	5	IND	29	IND
7. Bottles, reagent for side shelves	7	IND	7	IND	6	IND	3	IND	23	IND
8. Bottles, wide-mouth	8	186	8	226	7	403	4	415	27	1,221
9. Brush, test tube	8	128	8	121	6	98	5	335	27	682
10. Burner, Bunsen or equiv.	7	38	7	109	7	133	5	140	26	430
11. Burettes, 50 ml.	11	89	10	73	9	47	5	108	35	317
12. Cabinet, first aid	2	6	5	5	6	7	5	6	18	24
13. Chart, periodic table	10	16	9	28	7	12	4	9	30	65

TABLE 53-W continued

Item	Size of School									
	(14)* 1-199		(10)* 200-499		(10)* 500-999		(5)* 1000-up		(39)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
14. Chart, electrochemical series	5	6	3	3	4	4	2	2	14	15
15. Clamps, burette	11	118	9	107	9	135	5	242	34	602
16. Condensers and clamps	13	65	10	73	7	45	5	112	35	295
17. Conductivity apparatus	4	16	5	7	5	8	1	1	15	32
18. Cork borer set	9	19	7	10	5	5	5	8	26	42
19. Cork assortment	11	11	8	8	8	8	4	4	31	31
20. Crucible and cover	7	63	8	51	6	103	4	46	25	306
21. Cylinder, graduated, asstd	11	92	5	42	8	91	5	179	29	404
22. Desiccator with plate	2	6	4	11	3	4	4	6	13	27
23. Dish, evaporating	9	98	8	58	6	73	5	284	28	513
24. Electrolysis apparatus	8	17	8	14	7	21	3	27	26	79
25. File, triangular	7	31	7	38	7	57	5	393	26	519
26. Flask, florence	9	127	8	101	7	162	4	189	28	579
27. Flask, erlenmeyer	8	109	8	66	6	55	5	353	27	583
28. Forceps	7	58	7	66	6	145	3	140	23	409
29. Funnel	8	50	8	75	7	84	5	281	28	490
30. Funnels, Buechner's	3	25	3	4	3	14	3	4	12	47

TABLE 53-W continued

Item	Size of School									
	(14)* 1-199		(10)* 200-499		(10)* 500-999		(5)* 1000-up		(39)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
31. Gauze, wire	8	76	7	105	7	218	4	184	26	483
32. Generator, gas, Kipp	0	0	2	2	1	1	2	2	5	5
33. Glass plates and one cobalt plate	9	31	7	130	6	435	4	47	26	643
34. Graduated cylinder	8	59	6	64	7	95	4	179	25	397
35. Hot plate, electric	4	6	2	2	3	5	1	1	10	14
36. Hydrometer, universal	3	15	8	19	7	20	1	1	19	55
37. Kit, atomic model	1	1	1	1	1	1	0	0	3	3
38. Lamp, blast	0	0	1	1	0	0	0	0	1	1
39. Magnifiers, tripod or equivalent	6	71	5	46	4	56	2	4	17	177
40. Model, molecular	2	4	1	1	1	1	2	2	6	8
41. Mortar and pestle	8	52	7	54	7	70	5	95	27	271
42. Oven, drying	2	3	1	1	0	0	1	2	4	6
43. Ozone, generating apparatus	0	0	0	0	0	0	0	0	0	0
44. Pinchcock-compressor type	4	63	5	32	6	66	2	44	17	205
45. Pipettes, assorted	7	69	7	48	8	56	4	75	26	248
46. Rack, test tube	9	71	8	87	7	174	4	74	28	406
47. Retorts with glass stoppers	10	46	7	69	8	47	4	28	29	190

TABLE 53-W continued

	Item	Size of School									
		(14)* 1-199		(10)* 200-499		(10)* 500-999		(5)* 1000-up		(39)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
48.	Ring stands, assortment of rings and burette clamps	11	145	9	223	10	223	5	101	35	692
49.	Rubber stoppers, assortment	8	8	7	7	7	7	3	3	25	25
50.	Soil testing kit	1	3	2	2	0	0	2	2	5	7
51.	Spatula	6	21	7	67	5	63	3	33	21	184
52.	Spoon, deflagrating	6	53	8	69	6	92	4	685	24	899
53.	Spot plates	0	0	3	42	0	0	3	8	6	50
54.	Still, water	3	3	0	0	2	2	0	0	5	5
55.	Test tubes, assorted	8	860	8	450	7	1,319	5	492	28	3,121
56.	Test tube holder	8	137	8	125	7	140	4	304	27	706
57.	Thermometers, assorted	7	115	7	73	6	96	4	163	24	447
58.	Thistle tube	9	95	7	83	6	190	4	179	26	547
59.	Tubing, glass (lbs.)	8	158	6	216	7	248	4	37	25	659
60.	Tubing, rubber (ft.)	5	78	6	375	6	361	4	152	21	966
61.	Tong, crucible	7	59	7	50	4	83	4	97	22	289
62.	Trough, pneumatic	7	48	8	66	7	103	4	88	26	305

TABLE 53-W continued

Item	Size of School									
	(14)* 1-199		(10)* 200-499		(10)* 500-999		(5)* 1000-up		(39)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
63. Triangle, pipe-stem	7	73	7	106	7	132	4	259	25	570
64. Watch glasses	7	138	8	149	7	137	4	157	26	581
65. Weights, 10 grams to 1,000 grams	10	IND	8	IND	9	IND	5	IND	32	IND
66. Weights, analytical 50 mg to 100 mg	2	4	7	7	3	3	5	6	17	20
67. Wing-top for burner	8	49	7	82	5	55	3	89	23	275
68. Wire, platinum	3	IND	7	IND	6	IND	2	IND	18	IND
Semi-micro laboratory equipment?										
69. Yes	2		1		1		2		6	
70. No	12		9		9		3		33	
Equipment index	45.7		61.1		55.5		69.3		55.2	

*The number of schools in the category in which chemistry was taught.

IND - Indeterminate

TABLE 54-N

THE NUMBER (N) OF NEGRO HIGH SCHOOLS REPORTING THE LISTED ITEMS OF CHEMISTRY EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

Item	Size of School									
	(4)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(16)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
1. Balance, analytical	1	1	0	0	1	2	0	0	2	3
2. Balance, triple-beam or platform	3	5	6	13	3	16	0	0	12	34
3. Barometer, mercury or or aneroid	1	2	5	5	3	4	1	1	10	12
4. Beakers, assortment	2	IND	5	IND	3	IND	1	IND	11	IND
5. Blowpipe, 8 inch	1	2	1	1	1	1	0	0	3	4
6. Bottles, reagent for laboratory desks	3	42	6	81	3	288	0	0	12	412
7. Bottles, reagent for side shelves	3	44	2	32	3	121	0	0	8	197
8. Bottles, wide-mouth	2	75	2	56	4	184	0	0	8	315
9. Brush, test tube	2	20	2	28	4	47	0	0	8	95
10. Burner, Bunsen or equiv.	2	13	2	13	3	29	0	0	7	52
11. Burettes, 50 ml.	1	10	3	6	4	30	1	2	9	48
12. Cabinet, first aid	3	3	4	4	2	2	1	2	10	11
13. Chart, periodic table	2	2	6	6	3	4	1	3	12	15

TABLE 54-N continued

Item	Size of School									
	(4)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(16)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
14. Chart, electrochemical series	0	0	0	0	1	1	0	0	1	1
15. Clamps, burette	1	12	5	45	4	28	1	2	11	87
16. Condensers and clamps	1	5	5	18	4	28	1	6	11	57
17. Conductivity apparatus	2	2	2	7	3	9	0	0	7	18
18. Cork borer set	1	1	5	12	4	9	0	0	10	22
19. Cork assortment	2	IND	3	IND	2	IND	1	IND	8	IND
20. Crucible and cover	1	3	1	3	3	28	0	0	5	34
21. Cylinder, graduated, assortment	3	21	6	30	3	42	1	3	13	95
22. Desiccator with plate	0	0	1	1	3	7	0	0	4	8
23. Dish, evaporating	2	6	2	4	3	37	0	0	7	47
24. Electrolysis apparatus	1	1	3	10	3	11	0	0	7	22
25. File, triangular	2	7	1	1	4	24	0	0	7	32
26. Flask, florence	1	3	2	9	4	44	0	0	7	56
27. Flask, erlenmeyer	1	9	1	16	4	188	0	0	6	213
28. Forceps	2	20	1	3	2	25	0	0	5	48
29. Funnel	2	14	2	13	4	117	0	0	8	144
30. Funnels, Buechner's	2	5	2	5	1	1	0	0	5	11

TABLE 54-N continued

Item	Size of School									
	(4)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(16)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
31. Gauze, wire	2	25	2	7	2	21	0	0	6	53
32. Generator, gas, Kipp	0	0	0	0	1	1	0	0	1	1
33. Glass plates and one cobalt plate	2	24	1	12	3	16	0	0	6	52
34. Graduated cylinder	2	5	1	6	4	23	0	0	7	34
35. Hot plate, electric	1	1	0	0	0	0	1	1	2	2
36. Hydrometer,universal	1	1	2	5	2	7	0	0	5	13
37. Kit, atomic model	1	1	1	1	0	0	0	0	2	2
38. Lamp, blast	0	0	0	0	0	0	0	0	0	0
39. Magnifiers, tripod or equivalent	1	6	2	16	2	15	0	0	5	37
40. Model, molecular	1	1	0	0	1	1	0	0	2	2
41. Mortar and pestle	3	17	1	2	3	9	0	0	7	28
42. Oven, drying	0	0	1	1	0	0	0	0	1	1
43. Ozone, generating apparatus	0	0	0	0	0	0	0	0	0	0
44. Pinchcock-compressor type	0	0	1	1	4	64	0	0	5	65
45. Pipettes, assorted	0	0	3	7	2	4	0	0	5	11
46. Rack, test tube	2	13	2	8	3	46	0	0	7	67
47. Retorts with glass stoppers	3	3	5	23	2	11	0	0	10	37

TABLE 54-N continued

Item	Size of School (4)* 1-199 N	Q	(7)* 200-499 N	Q	(4)* 500-999 N	Q	(1)* 1000-up N	Q	(16)* Totals N	Q
48. Ring stands, assortment of rings and burette clamps	3	35	5	79	2	66	1	6	11	186
49. Rubber stoppers, assortment	2	2	1	1	4	4	0	0	7	7
50. Soil testing kit	1	1	1	1	1	1	1	1	4	4
51. Spatula	2	15	1	6	3	38	0	0	6	59
52. Spoon, deflagrating	2	5	1	3	4	50	0	0	7	58
53. Spot plates	0	0	0	0	0	0	0	0	0	0
54. Still, water	0	0	0	0	0	0	0	0	0	0
55. Test tubes, assorted	2	200	2	82	4	828	0	0	8	1,110
56. Test tube holder	3	28	2	11	2	11	0	0	7	50
57. Thermometers, assorted	2	16	5	36	3	36	1	4	11	92
58. Thistle tube	2	10	1	3	4	87	0	0	7	100
59. Tubing, glass (lbs.)	3	15	1	10	3	50	0	0	7	75
60. Tubing, rubber (ft.)	2	35	1	3	3	40	0	0	6	78
61. Tong, crucible	2	8	2	7	3	25	0	0	7	40
62. Trough, pneumatic	2	12	1	1	4	29	0	0	7	42
63. Triangle, pipe-stem	2	5	2	2	3	21	0	0	7	28

TABLE 54-N continued

Item	Size of School									
	(4)* 1-199		(7)* 200-499		(4)* 500-999		(1)* 1000-up		(16)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
64. Watch glasses	2	27	1	16	2	23	0	0	5	66
65. Weights, 10 grams to 1,000 grams	2	3	4	7	4	7	0	0	10	17
66. Weights, analytical 50 mg to 100 mg	0	0	2	4	2	2	0	0	4	6
67. Wing-top for burner	1	9	2	4	2	26	0	0	5	39
68. Wire, platinum	0	0	1	IND	1	IND	0	0	2	IND
Semi-micro laboratory equipment?										
69. Yes	1		0		0		0		1	
70. No	3		7		4		1		15	
Equipment index	38.0		30.4		62.0		20.3		39.5	

*The number of schools in the category in which chemistry was taught.

IND - Indeterminate

TABLE 55-W

THE NUMBER (N) OF WHITE HIGH SCHOOLS REPORTING THE LISTED ITEMS OF PHYSICS EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

Item	Size of School									
	(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
1. Air jet attachment, for tones	1	1	0	0	1	1	1	1	3	3
2. Ammeter, A.C., 1 amp.	4	4	4	8	3	13	2	10	13	35
3. Ammeter, A.C., 10 amp.	4	5	4	5	3	10	2	13	13	33
4. Amplifier, audio-freq.	0	0	2	2	1	1	2	2	5	5
5. Archimedes' Principle apparatus	4	4	1	1	2	2	3	4	10	11
6. Balances, platform	6	8	9	16	5	12	4	32	24	68
7. Balances, triple-beam	5	9	5	11	3	12	4	14	17	46
8. Balance, dial spring-500 grams	7	24	6	48	6	42	4	49	23	163
9. Balance, spring 250 gm	8	35	6	34	5	36	3	38	22	143
10. Balls, aluminum, 1 inch	2	2	3	4	3	9	1	24	9	39
11. Ball, inertia	3	3	1	1	2	2	3	3	11	11
12. Balls, lead 1 inch	2	2	3	3	1	2	2	42	8	49
13. Balls, wood	2	2	5	9	4	9	1	24	12	44
14. Balls, bouncing and non-bouncing	0	0	2	5	0	0	0	0	2	5

TABLE 55-W continued

Item	Size of School									
	(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
15. Ball and ring, expansion	9	10	7	9	6	8	5	6	27	33
16. Barometer, aneroid	6	6	5	5	4	4	5	6	20	21
17. Barometer, mercurial	4	4	3	3	2	2	4	13	13	22
18. Barometer, recording barograph	0	0	0	0	0	0	1	1	1	1
19. Battery jar--one gallon	6	17	7	32	6	7	2	7	21	63
20. Battery, storage	2	3	0	0	3	3	3	3	8	9
21. Battery substitute rectifier, 115 volt A.C. for low voltage A.C. and D.C.	3	4	4	5	3	3	1	1	11	13
22. Bell in vacuo	3	3	5	5	5	5	5	5	18	18
23. Bell jars, assorted	5	9	7	10	5	12	4	10	21	41
24. Bench, optical	6	11	1	1	5	10	4	13	16	35
25. Boiler, cryophorous	1	1	1	1	1	1	2	3	5	6
26. Box, resistance 3 dial	4	4	2	2	2	7	5	13	13	26
27. Boyle's Law apparatus, J form	3	3	4	4	4	9	4	11	15	27
28. Brownian movement apparatus	2	2	5	6	1	1	2	2	10	11

TABLE 55-W continued

Item	Size of School (13)* 1-199 N	Q	(10)* 200-499 N	Q	(9)* 500-999 N	Q	(5)* 1000-up N	Q	(37)* Totals N	Q
29. Burner, Bunsen type	6	48	8	93	3	48	5	54	22	243
30. Burner, Fisher type	3	4	4	5	2	2	1	1	10	12
31. Caliper, micrometer	7	9	5	8	5	20	4	22	21	59
32. Caliper, Vernier	6	11	9	13	7	16	4	37	26	77
33. Calorimeter	6	14	6	10	5	22	5	39	21	85
34. Camera, 35 mm Kodak or equivalent	1	1	2	2	0	0	0	0	3	3
35. Can, overflow	8	9	5	26	6	23	5	39	24	97
36. Capillary set	8	9	6	6	6	7	2	2	22	24
37. Cartesian diver set	1	1	2	7	4	5	4	5	11	18
38. Centrifugal hoop	5	6	2	2	3	3	2	2	12	13
39. Chart, spectrum	1	1	3	3	5	5	4	5	13	14
40. Clamps, condenser	1	24	5	18	3	21	2	18	11	81
41. Cell, student	5	12	3	10	6	17	2	36	16	75
42. Centrifuge, hand type	1	1	0	0	2	2	0	0	3	3
43. Clamps: Knife-edge	5	27	2	27	4	26	3	18	14	98
44. Pendulum	3	10	3	5	3	10	1	16	10	41
45. Right angle	3	11	4	15	1	1	2	22	10	49
46. Meter stick	7	30	4	17	4	18	3	9	18	74

TABLE 55-W continued

Item	Size of School									
	(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
47. Swivel	2	15	1	1	1	15	1	9	5	40
48. Tubing	2	28	7	72	4	44	2	41	15	185
49. Table	2	3	4	8	2	12	3	50	11	73
50. Lens	4	5	2	3	5	11	4	4	15	23
51. Coils, resistance set of 8	5	32	5	17	5	23	2	23	17	95
52. Cohesion figures	0	0	2	2	1	1	1	1	4	4
53. Coils, induction	6	6	4	6	6	7	5	11	21	30
54. Coils, primary and secondary	5	5	4	5	6	7	1	1	16	18
Compass:										
55. Declination	3	3	2	2	6	6	2	3	13	14
56. Inclination	0	0	2	2	3	3	4	4	9	9
57. Magnetic-jeweled	1	6	2	3	0	0	0	0	3	9
58. Magnetic, small	7	55	7	17	4	28	2	56	20	156
59. Conductometer	2	2	0	0	3	3	1	1	6	6
60. Convection box	2	2	0	0	1	1	2	2	5	5
61. Cord, extension, 5 ft.	7	14	7	11	3	10	3	5	20	40
62. Cord, linen for pulley	2	IND	4	IND	2	IND	3	IND	11	IND
63. Double cone and plane	0	0	3	3	4	4	2	2	9	9

TABLE 55-W continued

Item	Size of School									
	(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
64. Drawing compasses	1	12	3	20	1	1	1	40	6	73
65. Disk, siren and color	5	6	6	6	5	6	4	5	20	23
66. Dynamo, hand powered, demonstration	2	2	4	5	4	5	3	3	13	15
67. Electromagnet	5	5	3	8	4	5	4	9	16	27
68. Electromagnet attachment	2	2	0	0	0	0	2	11	4	13
69. Electrophorous	0	0	4	5	3	4	3	3	10	12
70. Electroscope, met.-leaf	7	7	4	6	6	7	5	13	22	33
71. Electroscope, pith-ball	4	4	4	4	3	4	3	12	14	24
72. Electrostatic demonstration set	3	4	3	4	4	5	1	1	11	14
73. Engine, working models, assortment	1	1	6	7	5	6	2	2	14	16
74. Files, triangular and flat	5	44	8	35	3	9	3	25	19	113
75. Filmloops, radioactive	0	0	0	0	1	6	0	0	1	6
76. Filings, iron (lbs.)	10	12	8	14	5	14	6	15	29	55
77. Force board	6	9	4	5	5	6	4	8	19	28
78. Fur, half cat skin	4	4	4	4	4	5	3	8	15	21

TABLE 55-W continued

	Item	Size of School									
		(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
79.	Fluoroscope, demonstration type	0	0	0	0	0	0	2	2	2	2
80.	Gear train	0	0	0	0	3	5	2	2	5	7
81.	Galvanometer, lecture table model	4	5	4	4	2	2	6	7	16	18
82.	Geiger counter	1	2	3	4	5	5	3	4	12	15
83.	Geissler tubes	0	0	3	3	4	6	2	5	9	14
84.	Generator, steam	4	10	3	6	6	13	3	17	16	46
85.	Generator, magneto-electric hand operated	3	3	3	3	5	5	4	5	15	16
86.	Glassware, assorted beakers, flasks, funnels	7	IND	7	IND	4	IND	5	IND	23	IND
87.	Glass, pulse	3	3	2	2	2	2	2	3	9	19
88.	German silver wire #22	2	IND	3	IND	2	IND	1	IND	8	IND
89.	Gyroscope	5	5	1	1	4	4	3	3	13	13
90.	Halls, carriage	8	16	5	6	5	13	3	14	21	49
91.	Hangers, weight	6	17	4	5	4	6	3	86	17	114
92.	Hooke's Law apparatus	5	12	1	1	8	19	4	17	18	49
93.	Hooke's Law spring	2	9	1	1	7	15	4	21	14	46
94.	Hydrometer, heavy liquids	6	11	6	9	6	10	5	24	23	54

TABLE 55-W continued

Item	Size of School (13)* 1-199 N	Q	(10)* 200-499 N	Q	(9)* 500-999 N	Q	(5)* 1000-up N	Q	(37)* Totals N	Q
95. Hydrometer jar	2	4	4	8	5	6	1	3	12	20
96. Hydrometer, battery	3	3	3	4	3	3	1	1	10	11
97. Hygrometer	2	6	4	5	4	7	4	21	14	39
98. Inclined plane	9	16	8	10	6	15	4	14	27	55
99. Jar, bell	7	12	7	16	5	9	4	9	23	46
100. Knife	1	2	4	13	4	6	2	2	11	23
101. Lamp, ultraviolet	2	2	3	3	1	1	3	3	9	9
102. Lamps, screw base	2	3	3	12	2	36	2	7	9	48
103. Lamp, carbon arc	0	0	0	0	2	2	3	3	5	5
104. Lamp socket assembly for series and parellel circuits	2	14	6	6	4	4	4	21	16	45
105. Lens, assortment	9	9	5	6	8	11	5	11	27	37
106. Lenses, spherical	2	7	4	11	2	6	2	19	10	43
107. Lead sinkers	2	7	2	IND	4	29	3	28	9	76
108. Leyden jars	3	5	5	7	5	7	4	24	17	43
109. Linear expansion apparatus (lever or micrometer form)	6	7	3	4	6	12	3	15	18	38
110. Liter case	0	0	0	0	1	1	2	2	3	3
111. Liquid set, fluorescent	0	0	2	2	0	0	1	1	3	3

TABLE 55-W continued

	Item	Size of School (13)* 1-199 N	Q	(10)* 200-499 N	Q	(9)* 500-999 N	Q	(5)* 1000-up N	Q	(37)* Totals N	Q
112.	Lever demonstration apparatus	5	11	4	4	5	7	3	8	17	30
113.	Lodestone	1	1	4	4	3	3	1	3	9	11
114.	Magdeburg hemispheres	4	4	1	1	6	3	4	6	15	17
115.	Magnet, Alnico	1	1	1	12	3	7	2	12	7	32
116.	Magnet, U	8	19	8	34	8	33	2	3	26	89
117.	Magnets, bar	9	28	8	47	7	35	2	25	26	135
118.	Magnets, assorted	5	24	2	12	2	12	2	44	11	92
119.	Metal, assorted strips	6	IND	7	IND	4	IND	3	IND	20	IND
120.	Meter sticks	9	54	9	61	7	68	5	77	30	260
121.	Meter stick, four scale	0	0	3	26	0	0	1	1	4	27
122.	Meter, foot candle	0	0	0	0	1	1	0	0	1	1
123.	Mirror, spherical	2	2	2	10	7	15	3	22	14	49
124.	Metronome	0	0	1	1	0	0	2	2	3	3
125.	Motor, St. Louis	7	13	5	6	3	7	4	13	19	33
126.	Model vernier	1	1	2	2	1	1	1	2	5	6
127.	Model engines, gasoline, cross-section for demonstrating four-cycle principle	1	1	1	1	2	2	0	0	4	4

TABLE 55-W continued

	Item	Size of School (13)* 1-199 N	Q	(10)* 200-499 N	Q	(9)* 500-999 N	Q	(5)* 1000-up N	Q	(37)* Totals N	Q
128.	Model engines, diesel, cross-section for demonstrating working principle	0	0	0	0	0	0	0	0	0	0
129.	Microphones, crystal and carbon	3	3	3	6	0	0	1	1	7	10
130.	Needle, magnetic	1	1	1	1	4	4	2	10	8	16
131.	Oerstad's Law apparatus, simple form	1	1	0	0	2	2	1	1	4	4
132.	Object holders for meter sticks	7	27	7	35	5	26	4	43	23	131
133.	Optical disk with acces.	3	8	1	1	4	4	5	5	13	18
134.	Organ pipe with sliding piston	1	1	0	0	3	3	2	2	6	6
135.	Osmosis apparatus	2	2	0	0	4	4	0	0	6	6
136.	Pascal's vases, simple form	0	0	2	2	1	1	1	1	4	4
137.	Pendulum	2	2	1	1	4	4	2	2	9	9
138.	Prism, equilateral	10	20	7	15	6	13	4	19	27	67
139.	Proof plane	0	0	1	1	0	0	1	8	2	9
140.	Protractors	1	6	4	23	3	21	2	52	10	102

TABLE 55-W continued

	Item	Size of School									
		(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
141.	Photoelectric cell and relay	1	1	1	1	0	0	2	2	4	4
142.	Photometer, Bunsen	4	6	3	4	3	4	3	10	13	24
143.	Physics charts	3	3	3	3	2	5	3	4	11	15
144.	Plate, index of refract.	1	1	3	3	2	2	2	13	8	19
145.	Polaroid kit	1	1	3	3	4	5	4	4	12	13
146.	Power unit, electric 110 A.C., variable A.C. and D.C. output	4	4	6	6	2	2	3	3	15	15
147.	Pulleys, assorted	12	95	9	73	7	68	4	103	32	339
148.	Pumps: Air	3	3	4	8	5	6	2	2	16	19
149.	Force model	9	9	4	4	6	7	2	2	21	22
150.	Lift model	9	9	4	5	6	9	2	2	21	25
151.	Vacuum, electric	1	1	2	2	4	4	5	5	12	12
152.	Oscilloscope, cathorde ray	0	0	1	1	0	0	3	3	4	4
153.	Radiometer	2	2	3	3	4	4	2	2	11	11
154.	Radio receiver, demonstration panel	0	0	1	1	0	0	1	1	2	2
155.	Rectifier, tungar	1	1	3	3	2	2	1	1	7	7

TABLE 55-W continued

Item	Size of School									
	(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
156. Reflectors, parabolic	0	0	2	2	0	0	1	2	3	4
157. Rods, 40 cm long	1	1	3	24	1	4	1	30	6	60
158. Rod, 100 cm long	3	31	3	15	0	0	1	4	7	50
159. Rods, assorted	1	4	2	58	1	20	0	0	4	82
160. Rotator, electric	0	0	0	0	3	3	1	1	4	4
161. Resistance boxes, asstd	4	4	4	6	2	6	5	13	13	29
162. Scale pans	1	4	3	16	1	2	0	0	5	22
163. Sheath, rubber	2	2	1	4	1	2	1	1	5	9
164. Singing flame apparatus	0	0	1	1	0	0	0	0	1	1
165. Soldering gun or electric soldering iron	1	1	3	3	0	0	3	3	7	7
166. Sonometer, simple form	0	0	3	3	6	7	2	3	11	13
167. Silk	5	5	7	7	4	4	3	8	19	24
168. Speaker, permanent magnet	0	0	2	2	0	0	1	2	3	4
169. Specimens, specific heat (sets)	2	2	4	5	2	2	1	2	9	11
170. Specimens, specific gravity (sets)	5	8	5	8	4	4	2	13	16	33
171. Specific gravity bottle	4	7	4	9	6	15	4	17	18	48

TABLE 55-W continued

	Item	Size of School (13)* 1-199 N	Q	(10)* 200-499 N	Q	(9)* 500-999 N	Q	(5)* 1000-up N	Q	(37)* Totals N	Q
172.	Spectroscope, direct vision	0	0	2	3	2	2	4	4	8	9
173.	Static machine, VanDE Graff	3	3	2	2	1	1	0	0	6	6
174.	Static machine, Wimhurst	1	1	2	2	2	3	2	2	7	8
175.	Storage cell apparatus	2	2	4	5	4	5	1	17	11	29
176.	Stethoscope	1	1	2	2	0	0	1	1	4	4
177.	Stirrups for bar magnet	2	2	1	12	1	2	1	24	5	40
178.	Support, magnet	2	2	2	3	2	2	1	5	7	12
179.	Switch, knife, one pole	9	25	4	26	5	11	4	40	22	102
180.	Switch, knife, two pole	5	17	3	10	4	10	4	18	16	55
181.	String vibrator	1	1	1	1	1	1	1	1	4	4
182.	Stroboscope, neon	0	0	1	1	0	0	1	1	2	2
183.	Syringe, pressure	0	0	2	3	1	1	0	0	3	4
184.	Taps, cell	0	0	0	0	0	0	0	0	0	0
185.	Tank, refraction	0	0	4	5	2	2	0	0	6	7
186.	Telegraph set	5	5	4	6	6	9	2	2	17	22
187.	Telephone station	1	1	4	8	3	4	1	1	9	14
188.	Television receiver	0	0	0	0	1	2	0	0	1	2
189.	Thermocouple	0	0	0	0	4	4	2	3	6	7

TABLE 55-W continued

	Item	Size of School									
		(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
190.	Thermometers, C. and F.	7	40	9	77	3	29	4	76	23	222
191.	Timer, interval	1	1	0	0	1	1	1	1	3	3
192.	Timer, stop watch	4	4	1	1	1	1	1	1	7	7
193.	Time control, electric	0	0	0	0	0	0	0	0	0	0
194.	Tripod	7	23	8	96	2	21	1	5	18	145
195.	Tripod base	3	7	3	25	1	8	1	4	8	44
196.	Trough, pneumatic	6	22	9	86	2	25	3	5	20	138
197.	Transformer, demonstration	4	4	4	10	5	4	3	3	16	21
198.	Tubes: Calibrated for liquid pressures	0	0	2	2	1	1	0	0	3	3
199.	Crookes, cathode ray	0	0	2	2	1	1	1	1	4	4
200.	X-ray	0	0	1	1	0	0	4	4	5	5
201.	Guinea and feather	0	0	1	1	1	1	3	3	5	5
202.	Barometer	2	2	5	6	4	6	1	1	12	15
203.	Resonance	1	1	4	4	4	5	5	8	14	18
204.	Tubing, glass (lbs.)	5	IND	9	IND	2	IND	2	IND	18	IND
205.	Tubing, rubber (ft.)	5	IND	9	IND	2	IND	4	IND	20	IND
206.	Tuning forks (sets)	9	19	8	12	9	14	5	11	31	56
207.	Tuning forks, sympathetic pair	2	2	5	6	8	9	1	2	16	19

TABLE 55-W continued

Item	Size of School									
	(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
208. Universal light source	2	2	4	4	2	2	2	2	10	10
209. Voltmeter, A.C.	5	8	3	3	3	4	5	8	16	23
210. Voltmeter, D.C.	4	4	3	4	5	14	2	4	14	26
Weights:										
211. Hooked, set	9	9	5	20	6	11	3	7	23	47
212. Metric, slotted (sets)	7	10	8	11	3	9	3	50	21	80
213. General laboratory (sets)	3	6	8	18	2	9	1	16	14	49
214. Set, 1-500 gms	3	6	8	18	3	7	3	18	17	49
215. Wire, bell #20	4	IND	5	IND	1	IND	2	IND	12	IND
216. Wire, steel, assorted	3	IND	1	IND	0	IND	2	IND	6	IND
217. Worm and gear set	0	0	0	0	1	1	1	1	2	2
218. Wheatstone bridge, slide wire model	4	4	1	1	4	10	5	13	14	28
219. Wheel and axle	3	4	2	2	5	12	5	9	15	27
220. Vibrograph	0	0	1	1	0	0	1	1	2	2
Tools:										
221. Cutters, wire	1	1	3	3	1	1	1	1	6	6
222. Hammer	2	3	2	2	2	2	2	2	8	9
223. Pliers, assorted	1	2	3	4	3	3	3	3	10	12

TABLE 55-W continued

	Item	Size of School									
		(13)* 1-199		(10)* 200-499		(9)* 500-999		(5)* 1000-up		(37)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
224.	Saw, hack	0	0	2	2	1	1	1	1	4	4
225.	Saw, hand	0	0	1	1	0	0	1	1	2	2
226.	Screw drivers, asstd	1	2	2	2	3	3	3	3	9	10
227.	Table vice	0	0	1	1	0	0	1	1	2	2
228.	Wrench, crescent	1	1	3	3	0	0	0	0	4	4
	Equipment index	23.7		33.7		34.0		47.1		32.1	

*The number of schools in the category in which physics was taught.

IND - Indeterminate

TABLE 56-N

THE NUMBER (N) OF NEGRO HIGH SCHOOLS REPORTING THE LISTED ITEMS OF PHYSICS EQUIPMENT, AND THE QUANTITY (Q) OF EACH ITEM AVAILABLE IN THE SCHOOLS, CLASSIFIED BY SIZE OF SCHOOL

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
1. Air jet attachment, for tones	0	0	0	0	1	1	0	0	1	1
2. Ammeter, A.C., 1 amp.	0	0	0	0	1	4	1	1	2	5
3. Ammeter, A.C., 10 amp.	0	0	0	0	1	5	0	0	1	5
4. Amplifier, audio-freq.	0	0	0	0	0	0	0	0	0	0
5. Archimedes' Principle apparatus	1	1	1	1	1	1	0	0	3	3
6. Balances, platform	1	3	2	3	4	18	0	0	7	24
7. Balances, triple-beam	1	1	2	2	2	3	0	0	5	6
8. Balance, dial spring-500 grams	1	1	0	0	2	5	0	0	3	6
9. Balance, spring 250 gm	2	7	1	1	2	17	1	6	6	31
10. Balls, aluminum, 1 inch	0	0	1	2	1	12	0	0	2	14
11. Ball, inertia	1	1	1	1	1	1	1	1	4	4
12. Balls, lead 1 inch	0	0	1	1	1	12	0	0	2	13
13. Balls, wood	0	0	1	1	2	13	0	0	3	14
14. Balls, bouncing and non-bouncing	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
15. Bell and ring, expansion	1	1	1	1	2	2	1	1	5	5
16. Barometer, aneroid	1	1	1	1	2	2	1	1	5	5
17. Barometer, mercurial	0	0	0	0	2	2	0	0	2	2
18. Barometer, recording boargraph	0	0	0	0	0	0	0	0	0	0
19. Battery jar—one gallon	1	1	1	1	2	6	1	1	5	9
20. Battery, storage	0	0	0	0	1	1	0	0	1	1
21. Battery substitute rectifier, 115 volt A.C. for low voltage A.C. and D.C.	0	0	0	0	1	2	1	1	2	3
22. Bell in vacuo	0	0	1	1	1	1	0	0	2	2
23. Bell jars, assorted	0	0	1	1	1	2	0	0	2	3
24. Bench, optical	0	0	0	0	1	1	0	0	1	1
25. Boiler, cryophorous	0	0	0	0	0	0	0	0	0	0
26. Box, resistance, 3 dial	0	0	0	0	1	1	0	0	1	1
27. Boyle's Law apparatus, J form	1	1	1	1	1	2	0	0	3	4
28. Brownian movement apparatus	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
29. Burner, Bunsen type	2	25	1	15	2	42	1	6	6	88
30. Burner, Fisher type	0	0	0	0	1	2	0	0	1	2
31. Caliper, micrometer	1	1	1	4	2	8	1	1	5	14
32. Caliper, Vernier	1	1	1	4	1	6	1	1	4	12
33. Calorimeter	2	3	1	3	2	12	1	2	6	22
34. Camera, 35 mm Kodak or equiv.	0	0	0	0	1	1	0	0	1	1
35. Can, overflow	1	1	1	3	2	2	1	3	5	9
36. Capillary set	0	0	1	2	0	0	0	0	1	2
37. Cartesian diver set	0	0	1	1	1	1	0	0	2	2
38. Centrifugal hoop	2	2	0	0	1	1	0	0	3	3
39. Chart, Spectrum	0	0	1	1	1	1	0	0	2	2
40. Clamps, condenser	0	0	0	0	1	6	1	4	2	10
41. Cell, student	0	0	0	0	2	13	0	0	2	13
42. Centrifuge, hand type	0	0	0	0	0	0	0	0	0	0
43. Clamps: Knife-edge	0	0	0	0	1	6	0	0	1	6
44. Pendulum	0	0	0	0	1	2	1	1	2	3
45. Right angle	0	0	0	0	1	7	1	2	2	9
46. Meter stick	0	0	1	5	1	12	0	0	2	17

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
47. Swivel	1	4	1	4	0	0	0	0	2	8
48. Table	0	0	1	2	1	3	0	0	2	5
49. Tubing	0	0	1	3	0	0	1	2	2	5
50. Lens	0	0	0	0	1	6	1	1	2	7
51. Coils, resistance set of 8	0	0	0	0	1	6	0	0	1	6
52. Cohesion figures	0	0	1	1	0	0	0	0	1	1
53. Coils, induction	0	0	0	0	2	2	1	1	3	3
54. Coils, primary and secondary (sets)	0	0	0	0	2	3	1	1	3	4
55. Compass: Declination	0	0	0	0	1	2	0	0	1	2
56. Inclination	0	0	0	0	1	1	0	0	1	1
57. Magnetic-jeweled	0	0	1	1	0	0	0	0	1	1
58. Magnetic, small	2	4	0	0	2	14	1	1	5	19
59. Conductometer	0	0	0	0	0	0	0	0	0	0
60. Convection box	0	0	0	0	0	0	0	0	0	0
61. Cord, extension, 5 ft.	2	2	1	1	1	5	1	1	5	9
62. Cord, linen for pulley	0	0	1	1	1	1	0	0	2	2
63. Double cone and plane	0	0	0	0	0	0	0	0	0	0
64. Drawing compasses	0	0	0	0	1	12	0	0	1	12

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
65. Disk, siren and color	1	2	0	0	1	1	0	0	2	3
66. Dynamo, hand powered, demonstration	0	0	0	0	1	1	0	0	1	1
67. Electromagnet	0	0	1	1	1	1	1	1	3	3
68. Electromagnet attachment	0	0	1	1	1	1	0	0	2	2
69. Electrophorus	0	0	0	0	1	1	0	0	1	1
70. Electroscope, met. - leaf	0	0	0	0	1	1	1	1	2	2
71. Electroscope, pith-ball	1	1	1	1	0	0	0	0	2	2
72. Electrostatic demonstration set	0	0	0	0	0	0	0	0	0	0
73. Engine, working models, assortment	0	0	0	0	1	1	0	0	1	1
74. Files, triangular and flat	2	6	1	1	1	12	0	0	4	19
75. Filmloops, radioactive	0	0	1	1	0	0	0	0	1	1
76. Filings, iron (lbs.)	3	3	1	1	3	5	1	2	8	11
77. Force board	0	0	0	0	2	11	1	1	3	12
78. Fur, half cat skin	0	0	0	0	2	5	0	0	2	5
79. Fluoroscope, demonstration type	0	0	0	0	0	0	0	0	0	0
80. Gear train	0	0	0	0	1	1	0	0	1	1
81. Galvanometer, lecture table model	0	0	1	1	2	3	1	1	4	5

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
82. Geiger counter	0	0	1	1	3	4	0	0	4	5
83. Geissler tubes	0	0	0	0	2	2	0	0	2	2
84. Generator, steam	0	0	0	0	2	13	0	0	2	13
85. Generator, magneto-electric hand operated	0	0	0	0	0	0	0	0	0	0
86. Glassware, assorted beakers, flasks, funnels	0	0	1	200	1	*	0	0	1	200
87. Glass, pulse	0	0	0	0	0	0	0	0	0	0
88. German silver wire #22 (roll)	0	0	0	0	1	1	0	0	1	1
89. Gyroscope	1	1	0	0	0	0	0	0	1	1
90. Halls, carriage	0	0	0	0	3	8	0	0	3	8
91. Hangers, weight	0	0	1	1	3	14	0	0	4	15
92. Hooke's Law apparatus	1	1	0	0	1	1	1	1	3	3
93. Hooke's Law spring	1	1	0	0	1	1	1	1	3	3
94. Hydrometer, heavy liquids	1	1	0	0	2	7	0	0	3	8
95. Hydrometer jar	1	1	0	0	1	4	0	0	2	5
96. Hydrometer, battery	0	0	1	1	0	0	0	0	1	1
97. Hygrometer	0	0	0	0	2	4	0	0	2	4

*Sufficient

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
98. Inclined plane	0	0	1	2	4	12	1	1	6	15
99. Jar, bell	0	0	1	1	1	1	1	2	3	4
100. Knife	1	1	1	6	0	0	0	0	2	7
101. Lamp, ultraviolet	0	0	0	0	0	0	1	1	1	1
102. Lamps, screw base	0	0	0	0	0	0	0	0	0	0
103. Lamp, carbon arc	0	0	0	0	0	0	0	0	0	0
104. Lamp socket assembly for series and parallel circuits	0	0	0	0	2	8	0	0	2	8
105. Lens, assortment	0	0	0	0	2	8	0	0	2	8
106. Lenses, spherical	0	0	0	0	1	1	0	0	1	1
107. Lead sinkers	0	0	1	6	0	0	0	0	1	6
108. Leyden jars	0	0	0	0	1	1	1	2	2	3
109. Linear expansion apparatus (lever or micrometer form)	0	0	1	1	2	3	0	0	3	4
110. Liter case	0	0	0	0	0	0	1	1	1	1
111. Liquid set, fluorescent	0	0	0	0	0	0	1	2	1	2
112. Lever demonstration apparatus	0	0	1	1	1	6	0	0	2	7
113. Lodestone	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
114. Magdeburg hemispheres	1	1	0	0	1	2	1	1	3	4
115. Magnet, Alnico	0	0	0	0	1	24	0	0	1	24
116. Magnet, U	0	0	1	2	3	17	1	1	5	20
117. Magnets, bar	2	3	0	0	2	14	1	3	5	20
118. Magnets, assorted	0	0	0	0	0	0	0	0	0	0
119. Metal, assorted strips	0	0	0	0	1	1	0	0	1	1
120. Meter sticks	3	7	1	6	3	24	1	6	8	43
121. Meter stick, four scale	0	0	0	0	0	0	0	0	0	0
122. Meter, foot candle	0	0	0	0	0	0	0	0	0	0
123. Metronome	0	0	0	0	0	0	0	0	0	0
124. Mirror, spherical	0	0	1	1	1	1	0	0	2	2
125. Motor, St. Louis	1	1	0	0	1	4	1	1	3	6
126. Model Vernier	0	0	1	1	1	1	0	0	2	2
127. Model engines, gasoline, cross-section for demonstrating four-cycle principle	0	0	0	0	1	1	0	0	1	1
128. Model engines, diesel, cross-section for demonstrating working principle	0	0	0	0	1	1	0	0	1	1
129. Microphones, crystal and carbon	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

Item		Size of School									
		(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
130.	Needle, magnetic	0	0	0	0	1	1	0	0	1	1
131.	Oerstad's Law apparatus, simple form	0	0	0	0	0	0	0	0	0	0
132.	Object holders for meter sticks	0	0	1	6	0	0	0	0	1	6
133.	Optical disk with acces.	0	0	1	1	0	0	0	0	1	1
134.	Organ pipe with sliding piston	0	0	1	1	0	0	0	0	1	1
135.	Osmosis apparatus	0	0	1	1	1	4	0	0	2	5
136.	Pascal's vases, simple form	0	0	0	0	1	1	0	0	1	1
137.	Pendulum	0	0	1	1	1	1	1	2	3	4
138.	Prism, equilateral	1	1	1	1	1	6	0	0	3	8
139.	Proof plane	0	0	0	0	0	0	0	0	0	0
140.	Protractors	0	0	1	2	1	4	0	0	2	6
141.	Photoelectric cell and relay	0	0	0	0	0	0	0	0	0	0
142.	Photometer, Bunsen	0	0	0	0	1	1	0	0	1	1
143.	Physics charts	0	0	1	1	2	2	1	3	4	6
144.	Plate, index of refract.	0	0	0	0	2	9	0	0	2	9
145.	Polaroid kit	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

	Item	Size of School									
		(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
146.	Power unit, electric 100 A.C., variable A.C. and D.C. output	0	0	0	0	0	0	1	1	1	1
147.	Pulleys, assorted	3	18	1	1	3	25	0	0	7	44
	Pumps:										
148.	Air	0	0	1	1	2	2	1	1	4	4
149.	Force model	1	1	1	1	1	1	0	0	3	3
150.	Lift model	2	2	1	1	2	2	0	0	5	5
151.	Vacuum, electric	0	0	0	0	2	2	0	0	2	2
152.	Oscilloscope, cathrode ray	0	0	0	0	0	0	0	0	0	0
153.	Radiometer	0	0	0	0	1	1	0	0	1	1
154.	Radio receiver, demonstration panel	0	0	0	0	0	0	0	0	0	0
155.	Rectifier, tungar	0	0	0	0	0	0	0	0	0	0
156.	Reflectors, parabolic	0	0	0	0	0	0	0	0	0	0
157.	Rods, 40 cm long	1	2	0	0	1	4	1	3	3	9
158.	Rod, 100 cm long	1	5	0	0	1	4	0	0	2	9
159.	Rods, assorted	0	0	0	0	0	0	0	0	0	0
160.	Rotator, electric	0	0	0	0	1	1	0	0	1	1
161.	Resistance boxes, asstd	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

Item	Size of School (3)* 1-199 N	(3)* 1-199 Q	(3)* 200-499 N	(3)* 200-499 Q	(4)* 500-999 N	(4)* 500-999 Q	(1)* 1000-up N	(1)* 1000-up Q	(11)* Totals N	(11)* Totals Q
162. Scale pans	0	0	0	0	0	0	0	0	0	0
163. Sheath, rubber	1	1	0	0	0	0	0	0	1	1
164. Singing flame apparatus	0	0	0	0	1	1	0	0	1	1
165. Soldering gun or electric soldering iron	0	0	0	0	0	0	0	0	0	0
166. Sonometer, simple form	0	0	1	1	2	3	0	0	3	4
167. Silk	1	1	0	0	2	2	0	0	3	3
168. Speaker, permanent magnet	0	0	0	0	0	0	0	0	0	0
169. Specimens, specific heat (sets)	0	0	1	1	1	3	1	1	3	5
170. Specimens, specific gravity (sets)	1	1	1	1	1	3	0	0	3	5
171. Specific gravity bottle	0	0	1	1	1	12	0	0	2	13
172. Spectroscope, direct vision	0	0	0	0	1	1	0	0	1	1
173. Static machine, Van De Graff	1	1	0	0	0	0	0	0	1	1
174. Static machine, Wimhurst	0	0	0	0	0	0	0	0	0	0
175. Storage cell apparatus	0	0	0	0	0	0	0	0	0	0
176. Stethoscope	0	0	0	0	0	0	0	0	0	0
177. Stirrups for bar magnet	0	0	0	0	0	0	0	0	0	0

TABLE 56-N continued

Item		Size of School									
		(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
178.	Support, magnet	0	0	0	0	0	0	0	0	0	0
179.	Switch, knife, one pole	2	3	0	0	1	6	0	0	3	9
180.	Switch, knife, two pole	2	3	0	0	1	6	0	0	3	9
181.	String vibrator	0	0	0	0	1	1	0	0	1	1
182.	Stroboscope, neon	0	0	0	0	0	0	0	0	0	0
183.	Syringe, pressure	0	0	1	1	0	0	0	0	1	1
184.	Taps, cell	1	1	0	0	0	0	0	0	1	1
185.	Tank, refraction	0	0	0	0	0	0	0	0	0	0
186.	Telegraph set	0	0	0	0	1	1	0	0	1	1
187.	Telephone station	0	0	0	0	0	0	0	0	0	0
188.	Television receiver	0	0	0	0	0	0	0	0	0	0
189.	Thermocouple	1	1	0	0	0	0	0	0	1	1
190.	Thermometers, C. and F.	2	4	1	6	0	0	1	4	4	14
191.	Timer, interval	0	0	0	0	0	0	0	0	0	0
192.	Timer, stop watch	0	0	1	1	1	1	1	1	3	3
193.	Time control, electric	0	0	0	0	0	0	0	0	0	0
194.	Tripod	3	10	1	2	0	0	1	1	5	13
195.	Tripod base	1	4	0	0	0	0	0	0	1	4

TABLE 56-N continued

	Item	Size of School									
		(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
		N	Q	N	Q	N	Q	N	Q	N	Q
196.	Trough, pneumatic	2	10	1	6	0	0	1	6	4	22
197.	Transformer, demonstration	0	0	0	0	1	1	0	0	1	1
198.	Tubes: Calibrated for liquid pressures	0	0	0	0	0	0	0	0	0	0
199.	Crookes, cathode ray	0	0	0	0	1	1	0	0	1	1
200.	X-ray	0	0	0	0	0	0	0	0	0	0
201.	Guinea and feather	0	0	0	0	0	0	0	0	0	0
202.	Barometer	1	1	1	1	0	0	0	0	2	2
203.	Resonance	0	0	0	0	1	1	0	0	1	1
204.	Tubing, glass (lbs.)	1	12	1	6	1	10	1	*	3	28
205.	Tubing, rubber (ft.)	2	34	1	20	2	30	1	*	5	84
206.	Tuning forks	2	7	1	2	3	13	1	3	7	25
207.	Tuning forks, sympathetic pair	0	0	0	0	2	6	0	0	2	6
208.	Universal light source	0	0	0	0	0	0	0	0	0	0
209.	Voltmeter, A.C.	0	0	0	0	2	3	0	0	2	3
210.	Voltmeter, D.C.	0	0	0	0	2	5	1	1	3	6
211.	Weights: Hooked, set	0	0	0	0	2	3	1	2	3	5
212.	Metric, slotted (sets)	0	0	1	1	1	2	0	0	2	3

TABLE 56-N continued

Item	Size of School									
	(3)* 1-199		(3)* 200-499		(4)* 500-999		(1)* 1000-up		(11)* Totals	
	N	Q	N	Q	N	Q	N	Q	N	Q
213. General laboratory (sets)	0	0	1	1	0	0	0	0	1	1
214. 1-500 gms (set)	1	1	1	1	0	0	1	1	3	3
215. Wire, bell #20 (rolls)	1	1	0	0	0	0	0	0	1	1
216. Wire, steel, assorted	0	0	0	0	0	0	0	0	0	0
217. Worm and gear set	0	0	0	0	0	0	0	0	0	0
218. Wheatstone bridge, slide wire model	0	0	0	0	1	1	0	0	1	1
219. Wheel and axis	1	1	0	0	1	1	0	0	2	2
220. Vibrograph	0	0	0	0	2	3	0	0	2	3
Tools:										
221. Cutters, wire	0	0	1	1	1	1	0	0	2	2
222. Hammer	0	0	1	1	1	1	1	1	3	3
223. Pliers, assorted	0	0	1	1	2	2	1	1	4	4
224. Saw, hack	0	0	0	0	0	0	0	0	0	0
225. Saw, hand	0	0	0	0	1	1	1	1	2	2
226. Screw drivers, asstd	0	0	1	1	1	2	0	0	2	3
227. Table vise	0	0	0	0	0	0	0	0	0	0
228. Wrench, crescent	0	0	1	1	0	0	0	0	1	1
Equipment index	11.8		12.7		22.7		25.0		17.2	

*The number of schools in the category in which physics was taught.

IND - Indeterminate

FLORIDA SCHOOLS SECONDARY SCIENCE STATUS STUDY 1959

Teacher Questionnaire

To the Teacher:

In an effort to appraise the status of science education in Florida it is important that information concerning science teachers, their backgrounds, and their opinions be sampled. Your response to this questionnaire will be most appreciated. Enclosed is a self-addressed, stamped envelope for your convenience. ALL RESPONSES WILL BE KEPT CONFIDENTIAL.

1. Florida certificate _____ 2. Rank _____ 3. Male ___

Female ____

4. Are you on continuing contract? Yes ___ No ___

5. Total years of science teaching experience. _____

6. College and University degrees: _____

7. Present salary: $2500 to 3000 _____
3000 to 3500 _____
3500 to 4000 _____
4000 to 4500 _____
4500 to 5000 _____
5000 to 5500 _____
5500 to 6000 _____
6000 to 6500 _____
Above 6500 _____

8. Do you perform work to supplement your present teaching salary? Yes ___ No ___

9. What duties other than that of classroom teacher are you expected to perform?

_____Bus duty
_____Club Sponsor
_____Gate duty at athletic events
_____Lunch room duty
_____Hall duty
_____Library duty
_____Others _____

10. What seems to be the greatest difficulty that you encounter in your science classes?

_____

11. What do you feel can be done to eliminate this difficulty at the local level?

at the state level?

at the national level?

12. What changes or additions, if any, would you recommend to improve the science program in your school?

_____

_____

13. What professional courses in education have been most helpful to you in your teaching? _____

_____

14. What courses other than professional education have been most helpful to you in your teaching? _____

_____

15. Given the opportunity, what courses would you take to add to your competency as a teacher? Please list them in order of preference:

1. _____
2. _____
3. _____
4. Others: _____

ACADEMIC QUALIFICATIONS CHECK-LIST

Name School

RANK I II III IV FLORIDA CERTIFICATE AREAS(LIST)

SUBJECTS TAUGHT THIS YEAR GEN SCI BIO CHEM PHYSICS

OTHERS

ACADEMIC DEGREES NONE BACH. OF MASTER OF DOCTOR OF

ACADEMIC BACKGROUND: BIOLOGY	SEM HRS	QTR HRS
GEN INTRO BIO	GENETICS	
VERT ZOO	HUMAN ANATOMY	
INVERT ZOO	HUMAN PHYSIOLOGY	
BOTANY	BIO FOR TCHRS	
ECOLOGY		

ACADEMIC BACKGROUND: CHEMISTRY	SEM HRS	QTR HRS
GEN COL CHEM	ADV INORGANIC	
QUAL	ADV ORGANIC	
QUANT	CHEM FOR TCHRS	
ORGANIC		
PHYSICAL CHEM		

ACADEMIC BACKGROUND: PHYSICS	SEM HRS	QTR HRS
GEN COL PHYSICS	OPTICS	
THERMO	MECHANICS	
ELEC & MAG	SOUND	
ATOMIC PHYSICS	PHYSICS FOR TCHRS	
NUCLEAR PHYSICS		

ACADEMIC BACKGROUND: MISC	SEM HRS	QTR HRS
ASTRONOMY	GEOLOGY	

ACADEMIC BACKGROUND: MATH	SEM HRS	QTR HRS
INTRO COL MATH	INTEGRAL CALCULUS	
COL ALGEBRA	THEORY OF EQUATNS	
TRIG	DIF EQUATNS	
ANALYT GEOM	MATH FOR TCHRS	
DIF CALCULUS		

NOTES AND ADDITIONS

Reaction Report #1

As I look back on my visits to the ten schools assigned to me, the observation giving me the greatest concern is the shortage of space and equipment available for the teaching of chemistry and physics, and the apparent lack of interest in these subjects shown by the school authorities. Biology is in general handled in a much better way, as far as "facilities" are concerned.

Without attempting to judge the individual teachers, I got the impression that physics and chemistry were being "taught" because they were required subjects - not because of the subject matter or of its importance to the pupil after he left school. To a somewhat lesser degree the same criticism must be made of the "General Science" classes. The biology classes, however, seemed to fare much better. The teachers seemed much more interested in their subject and appeared to arouse more interest in their pupils.

Of course, I as an outsider could not determine who is to be held responsible for this condition. In several cases, it appeared to me that the teachers themselves were at fault - either thru lack of interest, of initiative, or of knowledge. In other cases, the responsibility seemed to rest on the principals and/or on the school boards. In nearly every case, when the lack of space and equipment was mentioned, it was attributed to "lack of funds." Yet in not a single case would the teacher say that he or she had presented an orderly and well considered request for more space or better facilities or even admittedly necessary basic equipment. The nearest approach to such a statement was to the effect that he or she had talked it over with the principal or the head of the "science department" and had been told that "the funds were not available." This lack of funds was proably a fact in most instances. But why? Possibly in the final analysis, the responsibility comes to rest on the shoulders of the taxpayers. But shouldn't the science teacher himself take the initiative and through his principal and his school board, and also through his pupils, awaken the taxpayer to the conditions? I got the impression from most of the schools that the teachers' attitude was one of resignation or defeatism. "This is what we have to work with and we might as well like it."

Another observation that caused me considerable anxiety was the overloading of those teaching the "sciences" and a correlary to this, the "teaching" of a science by someone not trained in science or in the teaching of a science.

In not a single case did I find a teacher of chemistry, physics or of general science who had any scheduled time for preparation of experiments or for consultation with his or her pupils! Some had six scheduled classes and others five, with the sixth period alloted to some other phase of school work. In one case, for example, this "class free" period was to be devoted to "advisory work" with students, and for this period the teacher had to use the school lunch room!

In some of the schools, some teachers who were teaching one of the sciences (most frequently "General Science") admitted privately that they were "not interested" or "not prepared" for such classes and were assigned them because they had a "free period." Again I ask (rhetorically) Why? Various excuses were offered by the department heads or principals when the question was asked. Again - lack of funds. But also, shortage of teachers, shortage of trained science teachers, etc., etc. In one school, the reply was to the effect that "we rotate our chemistry and physics, teaching each every other year, and are not allowed to have ateacher for only one subject." So the teacher taught six classes, one of which was either physics or chemistry, and taught that subject in a class room "from the book" without even a demonstration desk! Having been a teacher myself, I can sympathize with such teachers and can admire some of them for accomplishing as much as they do accomplish. However, the situation is deplorable; it is unfair to the teacher, to the pupils and in the long run to the taxpayer. Again I think the teachers and the principals should be attempting to correct the conditions and not be accpeting them with apparent complacency.

One more observation. In several of the schools opportunities had arisen where certain equipment could be and was obtained. Much of this is of no use to the school at present. For example, one school had a photographic enlarger but no dark room and no other photographic equipment. In another case, the equipment had been obtained by a teacher who then left the school and the present teacher didn't know the name or use of some of the equipment. Needless to say, in both the cases, equipment fundamental to the teaching of physics and chemistry was woefully meager. Again I am tempted to ask why? In such cases, there seems to be a lack of interest and understanding on the part of the teacher and a lack of supervision on the part of the principal. I wonder what would be the school board's reaction if this were called to their attention.

Finally, and this is meant sincerely, I found much to be praised during my trip. Especially in the smaller schools the principals were making every effort to give the pupils as much as they could with the facilities on hand. In these schools also, the morale of the teachers and the students was very good. There was some evidence that facilities may soon be bettered in the overcrowded larger schools, where some effort seems to be made to secure federal aid for this purpose. In nearly all the schools I visited I found at least one and, in several cases several, science teachers, dedicated to their work, and distinctly hopeful that situations, admittedly bad now, could be improved in the near future.

In conclusion, I would like to see the report of our committee emphasize very strongly that the help - financial and moral - of the parents and taxpayers of each community be enlisted to bring about the much needed improvement in our Science Facilities. Co-operation of local school authorities, parents and pupils, rather than a "Big Whip" wielded by either side is what is needed to accomplish this goal.

Reaction Report #2

I found the work in connection with the Florida Secondary School Study most interesting. It helped me a great deal personnally in my work so I was very glad to be a part of it. My first impression is that the whole program was most interesting and revealing. I found very fine cooperation on the part of the school principles in the schools visited. I found also that they were very interested in the study as well as realizing that a great deal needed to be done in this phase of science education.

In every case I found the same shortage in science equipment and supplies as well as lack of trained science teachers. In general I found that the schools were inadequately equipped. In many cases where they did have some equipment, much of it was in a state of poor repair, in some cases probably due to a lack of understanding on the part of people purchasing the equipment, some fine equipment was available but had parts missing which rendered it useless. In practically every case that I visited I found the science equipment and supplies very inadequate and far inferior to that I had observed in schools in the northern part of our country. Not only did I find the science equipment and supplies inadequate, but I found the space and other teaching facilities inadequate. In some of the new schools where they had planned well, as far as space was concerned, the space could not be utilizedto its fullest extent because of the lack of equipment and facilities for teaching. For example, I found some laboratories equipped with water, gas, and electricity, which was very adequate, but they had no means of using water, gas, or electricity in their teaching. In some cases I found very adequate dark rooms which were used only as junk rooms because there was no equipment available for the use for which they were intended. One encouraging note, I found other cases where the school teachers were showing a great deal of ingenuity in making equipment to demonstrate science principles and in having their students do the same thing as extra projects.

I hope that when the study is completed that the results will be made available to the schools visited as well as to the rest of the state. All of the teachers expressed a great deal of interest in being able to obtain the results of this study.

Reaction Report #3

Eight of the ten schools I visited were small schools; half of them had a graduating class of 25 students or less. Six of the schools had 13 or less faculty members; all of these were found to be isolates or semi-isolated. Four of the schools were housed in antiquated, obsolete buildings.

Generally speaking, the science teachers in the small schools seemed to be making a greater effort to develop an adequate science program. They complained less about what they did not have and made greater use of improvised and natural teaching resources or tools.

Equipment, supplies, and teaching aids were limited in all schools. My reaction is that teachers from the larger and more adequately equipped and supplied centers would evaluate these materials as completely inadequate.

The lack of teaching tools has forced most of the teaching into a textbook (recall value) program. This type of process seems to be effective in its way since students (as reported by principals) do alright on statewide Senior Placement Tests. The students appear to learn what the tests measure.

My emotional reaction was one of shock. We read about the explosion of knowledge in all areas of science--it is featured in everything from the comics to the organs of the learned societies; one hears it on the radio, see it on TV, and it is commercialized to the extreme. I walked into schools and found equipment that was familiar to students during the hey day of the academies! Students must get vicariously, if they get it at all, the scientific attitudes which seem to characterize the individuals who have generated the explosion of scientific knowledge. I was left with feelings of shock, fear, and futility--I wondered if we were sending to the next generation what was needed.

Reaction Report #4

The schools I visited had inadequate science programs. This may be due to the fact that they were small high schools where funds were limited or they were in rural communities where teachers are hard to employ. Most of the schools had poor or improper classrooms and laboratories for teaching science. Equipment inventories were low and frequently consisted of outmoded and out-dated equipment.

In spite of the many physical obstacles, I found that most of the teachers were doing a good job of teaching science. In one school the teacher used a regular classroom, had only improvised equipment, had no free time during the day, had no funds with which to provide equipment, yet produced two students who won a local science fair and were entrants in the state fair. His students were learning more science than some of the students in modern, large high schools.

In another school in the same area in which the physical situation was about the same, there was very little activity in the science program. It seems as if the science teacher is a significant factor in the success of a science curriculum.

Reaction Report #5

My general reaction to the visits which I made in the schools of Florida to survey the science facilities and equipment is that my prior opinion concerning the status offacilities and science equipment in the schools of Florida has been validated. My opinion was that the situation was not good and my findings bore this out. I found only one school that I would consider to be fairly well supplied and laid out as far as facilities and equipment for a complete program are concerned. I found some schools that were well laid out and equipped for some of the sciences but not for a well-rounded program. For instance, I am thinking of two schools which were fairly well laid out and equipped for biology and chemistry but weak in the areas of physics and general science. The weaknesses in these two cases were in the fact that the rooms were not properly furnished,they did not have the proper type of demonstration table or the laboratory tables for the students to use nor was there much equipment available. A majority of the schools that I visited had insufficient and inadequate facilities and equipment. Some of them had laboratory desks for students which were poorly selected and not designed for the purpose to which they were being put. In one I found inadequate facilities but a fair amount of equipment. In another I found a fairly good layout but a poor supply of equipment. I found no school that was completely equipped and laid out for a well-rounded science education program. Even the school that I mentioned above as being fairly well equipped and laid out could not be considered in this respect because this was in terms of the program which they were offering at the time. If the program was as it should be and the enrollments as they should be, the facilities and the equipment would be inadequate.

I was impressed by what was being done by the science teachers in spite of the shortage of equipment and the inadequacy of the facilities. There was much evidence of clever improvising of equipment and adapting surplus equipment to use in the classroom for demonstration purposes and even for student activities. There was also evidence of student activities along this line. There was evidence of much use of natural resources such as school gardens, nature trails, homemade collections of various types. There were many student projects of various kinds on display and stored in the store rooms.

I was encouraged by the extent of the interest on the part of the science teachers. I found the interest to be high and the apathy which had surrounded science

programs in the past seems to me to be largely dispelled. Plans were being made for new courses, new equipment, more laboratory experiences, getting new or additional teachers, and that sort of thing. I was particulary pleased to find this going on to a large extent in one of the schools located in a smaller and less wealthy community. I imagine that the bulk of this increased interest and lessened apathy and greater enthusiasm for the science program has resulted from NDEA funds and can largely be attributed to the fact that the funds were made available and equipment was already on hand in many cases.

Reaction Report #6

Report of inspection of Eleven High Schools in Scattered Rural sections of Florida to determine available Facilities for Teaching the various Sciences.

These high schools were located either in small towns or adjacent thereto and students for the most parts were brought to the schools by buses.

Buildings

Most of the buildings were aged and some were inadequate. They lacked either sufficient class or laboratory rooms and storage space or closets were mostly of a make shift nature.

Adequate daylight in general was available but the type of windows used should be given consideration. Some were of such construction that in case of fire blocking the room exits the students could neither raise nor climb through them.

Artificial lighting in many cases was provided by incadescent light fixtures. Not often but in some instances the lighting could be improved by use of florescent fixtures and at less electric cost.

It was noted that where florescent lighting fixtures were used they were not always properly located, they were either too high above the writing surface, not correctly placed or had incorrect or wrong type of tubes or fixtures.

In multiple floor buildings double exits from rooms or exits lights were not always available or lighted.

The size of rooms alloted to lecture and laboratory use was insufficient. In some cases both were consolidated and in the same room. Storage room for instruments, equipment or usable materials was not provided when the building was constructed. Some of the high school principals in order to protect certain valuable laboratory or camera equipment were storing these articles either in their own locked offices or in some other non-associated locked cabinet. It was reported that owing to the lack of storage space valuable equipment losses were experienced regardless of the efforts of science teachers to safe guard the equipment.

A few of the schools had standard laboratory tables, but most of these were not properly equipped. Some lacked such items as, water, compressed air or adequate DC and AC electric outlets, sinks or proper disposal facilities. Table or over-head lighting was not proper for these tables. Separate laboratory rooms were not provided for Physics, Chemistry or Biology purposes. Where one laboratory was used jointly for these sciences the teachers were

greatly handicapped by lack of space. Specimen cabinets, as such, were not available in any of the schools but in some the students or teachers had taken sufficient interest to build shelving for exhibiting their collected specimens.

It is suggested these features should be given consideration in any remodeling of existing schools or in the construction of any new high school buildings.

General Remarks

In the majority of schools there was insufficient laboratory instruments or equipment to properly carry out all of the prescribed experiments. There was a lack of uniformity in the equipment furnished. There seemed to be adefinite need for standardization. Let me illustrate: a few of the high schools had certain instruments such as student microscopes while others had none, although needed. Where there was a shortage of biology items one ingenious County Superintendent resorted to transferring the expensive items from school to school. While this method helped out, the shortage was still there and this was very inefficient as the items were not always available, at the proper time. Inquiry as to the reason for this situation was attributed to the lack of money allotments. Here again there was a lack of uniformity in the distribution of available funds. It appeared that while the funds might have been prorated on an equiable basis, this did not meet the situation as the requirements of the schools were variable; that is some schools required more funds than others to obtain the proper equipment. While the above comments applies to laboratory equipment and funds allotted for that purpose, the same situation applied to useable items.

A review of this situation indicates a need for some cross county supervision of high schools. This can be illustrated by a large amount of test tubes or similar items at one high school and a complete lack of these at others. Let me give another example: one school had an excessive amount of glass tubing and others had none or a very little. Some savings could be made by a redistribution of surpluses to schools lacking the various items.

Requisitions

Requisitions for instruments and useable equipment were in some instances prepared by the science teachers, principals or county Superintendents. Some requisitions were subjected to supervision by the latter two. A review of this indicated that many times needed items were deteted from the requisitions to keep within the appropriated funds without consultation with the science teachers. This caused shortages of some items.

It is suggested that a study should be made by a competent state authority to cover the standardization of the necessary science equipment. This study should also cover the annual useable materials required giving due consideration to the various number of students or size of school involved. Equipment should be provided on the basis of the standardized list and authority delegated to the proper agency to see that the requirements are met. Likewise as previously mentioned proper storage facilities should be provided and thefts, breakage of loss of equipment reported and replacements made immediately.

It is realized that the proper standardizations for the various science subjects is a difficult task owing to the many variables involved but the recent review indicated some type of correction is needed.

Teachers

While a scientific review of the teachers was not attempted as part of this study certain observations were worthy of note. Owing to sickness or resignations certain teachers were called upon to teach certain subjects for which they had not been previously trained. While they were doing their best and following the text books, they could not improvise where equipment was not available as readily as a trained science teacher. Even the trained science teachers in many instances were resorting to make shift items or methods owing to the lack of necessary facilities. Some experiments outlined in the text books could not be performed for the same reason.

It was interesting to note the high caliber of the colored school science teachers. They were graduates of Florida A. and M. and the principles were either teaching a science course or substituting for a science teacher when needed.

Advertising

Public interest in the teaching of science subjects was lacking. In the eleven schools visited there was no report of parent interest in these subjects. While the public did show an interest in football, baseball and sports and in some instances contributed funds, in no case were any funds contributed as a prize to an outstanding science student by any local individual or industry. In these eleven communities there were no parent teachers associations.

In only one case was there a science fair and some exhbits by pupils of the elementary grades indicated remarkable latent scientific talent.

In some of the larger high schools the students have formed "Science Societies." None existed in the eleven schools visited.

As a suggestion it would appear that considerable advertising might be in order by the showing of free movies in the auditoriums. It is believed that industries would be glad to participate. Unless the interest in scientific subjects is increased we will fall behind other nations. Industries are generally complaining of the lack of available scientific personnel.

Colored Schools

It was interesting to observe that the principals and science teachers were of a high grade and with the limited facilities available seemed to be doing an excellent work. The student deportment on the days of inspection was outstanding.

Home Economics equipment in all cases was outstanding and the equipment provided exceeded that provided for the other sciences. Large Home Economics classes were involved and considerable interest was in evidence on the part of the students.

Libraries

The majority of the white schools visited had a fair quantity of science books, magazines and pamphlets. The colored schools as compared to the white schools were deficient in this respect. Even so there was much need for improvement as the libraries had not kept up with the development of the sciences.

In one school the principal recognizing this fact had appealed to various industries for literature on outstanding chemical and airplane developments and was given considerable data by certain industries.

Text books

A casual review of the text books seemed to indicate a need for a complete revision. While no attempt was made to analyze the relative merits of the various authors book's, it was observed that all schools were not using the same text books. It is believed that some of the science text books could be improved to cover many of the more recent scientific developments.

Discipline

It was noted that some of the teachers were having a disciplinary problem. Interruptions in class were frequent and these were not related to the subjects involved. Basically, this seems to be a home problem as the teachers were apparently not receiving proper support from parents.

Lack of manners and disregard of teachers requests within the class were frequent. Requests of the parents to excuse Willie from classes, due to a minor need for Willie for this or that errand seemed to take precedence over the vital school work.

As a whole the teachers seemed to be making a conscientious effort to instruct the students in spite of the many handicaps.

BIOGRAPHICAL SKETCH

Shepard Mazor Faber was born August 8, 1928, at Brooklyn, New York. He moved with his family to Florida in 1934, and graduated from Miami Beach High School in June, 1946. In August, 1949, he received the degree of Bachelor of Arts from Emory University, and in January, 1951, the degree of Master of Arts from Columbia University Teachers College. From 1951 until 1953, he served in the United States Air Force. Mr. Faber taught high school in Starke, Florida, for two years, during which time he was enrolled at the University of Florida as a part-time graduate student. He returned to the University in 1956, as a full-time student and was a graduate assistant in the Department of Physics for three years.

Mr. Faber has served on the faculty of the University of Florida as an Interim Instructor in the College of Education, and is presently engaged as Assistant Professor of Science Education on the faculty of East Carolina College, Greenville, North Carolina.

He is married to the former Mary Annette Harbin of Montgomery, Alabama, and is the father of four boys. He is a member of the National Science Teachers Association, Kappa Phi Kappa, Phi Delta Kappa, and Sigma Pi Sigma.

This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of that committee. It was submitted to the Dean of the College of Education and to the Graduate Council, and was approved as partial fulfillment of the requirements for the degree of Doctor of Education.

August 13, 1960

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